THE

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ELECTRIC COOKING AND HEATING.

THE tendency to follow on the beaten track may be observed in the development of almost all new industries and inventions; we feel our way from step to step, groping more or less blindly, often retracing our steps to branch off in another direction—and in the long run we arrive at results which, in the light of later knowledge, frequently appear to be the perfectly obvious outcome of quite early stages in the process of evolution. Thus, for example, the first railway coaches were designed very much on the lines of the existing road vehicles, and only by slow degrees acquired new forms and characteristics; the electric radiator still tries to resemble a coal fire, and the electric oven has usually been in the main a gas oven electrified. The march of progress, however, is introducing us to new ideas and new methods, and modifying our innate prejudice in favour of things as they are.

The fact that an egg could be cooked in boiling water did not directly reveal to us the deduction that meat in general could be cooked at the same temperature, or lead us to the conclusion that most of our cooking could be accomplished in a similar way, and consequently we have adhered to the established practice of countless generations when attacking the problem of electric cooking. We are, therefore, somewhat taken aback on learning from an Australian correspondent that the egg-boiling system of cookery has been seriously considered on the west coast of America, and has been brought to a remarkably high pitch of efficiency. The ingenious apparatus which has been evolved is described in our "New Devices" columns, and merits commendation on the score not only of its novelty and efficiency, but also of the simplicity of its construction and mode of operation. The system has obvious limitations, and cannot be expected to fulfil all the functions of a well-designed electric oven of the customary type; on the other hand, it has advantages which the latter does not possess, and which should render it invaluable in many households. From the figures given by Mr. Fisher, it is clear that the cost of cooking with this type of oven is less than half the cost with gas, whether we take the prices of gas and electricity that he gives, or reduce them to the rates prevailing here—roughly, two-fifths of those quoted; the low cost of electricity in this case is largely owing to the diminished loss by radiation and convection, due to the low temperature employed. The automatic regulation is another very valuable feature of the device, solving as it does the much-debated question whether it is better to try to teach the cook the use of a thermometer, or to trust to her common-sense, which is a decidedly doubtful quantity.

We do not suggest that this type of cooker would be suitable for an establishment where the magnitude of the culinary operations or the means of the owner warranted the employment of a competent cook and the installation of a complete outfit of cooking appliances; but where the mistress of the house herself performs all the domestic duties of a small household, the liberty of action and the freedom from all anxiety as to the progress of the cooking afforded by this method should prove an immense convenience to her, while the load resulting from the use of such cookers, inherently possessing a good load factor and small maximum demand, would be a most desirable one from the station engineer's point of view. We commend the idea to the attention of British manufacturers as offering a very promising field for their enterprise.

We wish to bring to their notice also the article on efficiency in connection with the electrical heating of water,

which appears elsewhere in this issue. The necessity of attention to small details in design, which might seem trivial, but are really important, is clearly demonstrated, and we think that designers of electrical apparatus for this purpose will find it worth their while to study the suggestions that are put forward.

Copper.

There has been a period of firmer markets in copper during the last few weeks, but, for all this, there seems to have been little improvement in the underlying conditions of the market in the United States. The dominant factors are regular production, and an enormous falling off in European consumption. Competent authorities are of opinion that during the month of August—even assuming that the United States home consumption was equal to that of the largest month on record—there must have been an increase in the stocks of refined copper held by refiners there of about 12,000 to 13,000 tons. It would appear, therefore, that the exports from the United States must either increase very substantially, or output must be reduced, before the copper can be stated to stand in a sound position. On the other hand, the bear account in the London market has been practically wiped out, and, apart from manipulative possibilities, it really needs no common courage to buy copper for the rise under the conditions at present ruling. The disparity between the prices of standard copper and refined copper is, moreover, a disturbing consideration, therefore it is a matter for satisfaction that further quantities of rough copper have been purchased here by the Government, and will be shipped to America for refining, the finished product being returned to this country. The statistics just issued were certainly better than had been expected, there being a reduction in the total stocks in England and France of over 2,000 tons during the first half of the month, while the European visible stocks underwent an almost identical reduction.

The greatest interest has been, and is still, paid in Australia to the efforts made by the authorities there to wipe out German interests in all departments of the Australian metal industry, and the *Australian Mining Standard* is taking a leading part in the agitation conducted there against all companies interested in the Australian metal trade and having Teutonic connections. It is beyond dispute that German influences have for many years predominated in the Australian metal trade, and the fact that this condition of affairs arose entirely from the blindness and indifference of British interests, seems now to have spurred the latter on to recover that dominance in the industry which it should never have lightly forfeited. That the Australians are inflexibly determined to drive out all interests smacking of Germany is a matter for patriotic congratulation, although whether the Commonwealth Government will succeed in their endeavours to establish firmly a metal exchange which can approach in importance that already existing in London, is a matter upon which there may easily be two opinions. The Federal Attorney-General is prompted by the very natural desire to preclude all Australian metals getting into the enemy's hands, or into the hands of neutral friends of the enemy, and to prevent British and allied buyers being exploited by the manipulation of the market, while having in view the preparing of the way for the control of the industry after the war by British firms. Meantime, the Melbourne Metal Exchange is to be under the direct control of the Commonwealth authorities, and the closest scrutiny will be kept upon all exports.

The prime factors in the Australian metal trade were of course the Metall-Gesellschaft and Aron Hirsch & Son, both of Germany, who were represented there by local houses. It is against these and the British connections of the first named, Messrs. Merton, that the activities of the Commonwealth Attorney-General and the Commonwealth Press are mainly directed. There can be no question but that a very strong case has been made out by the Commonwealth authorities as against German interests and German influences, and there can equally be no doubt whatever that these interests and influences can find no place in Australia for years to come. Australia has complained bitterly that her soldier citizens should have fallen in thousands by means of Australian copper, lead and spelter, and they are running no risks of any repetition of this state of affairs. Possibly in years to come the bitterness may subside, but all patriotic Britons are agreed in this, that the best place for Germans to-day is Germany, and that the Australian Commonwealth has no use or countenance for the type of people which has developed under the *régime* of "Kultur," and whose political perfidies and military atrocities reek to High Heaven.

The Italian Market.

Apart from the home production of electrical machinery and apparatus in Italy, the market in that country for some years past, as has repeatedly been shown, has been largely dominated by German and Swiss firms, and on the entrance of Italy into the war arena at least one company in Italy felt constrained to give public intimation that Teutonic interests were not concerned, or were no longer concerned, with the undertaking. On the conclusion of the war it will only be natural for the Swiss firms to endeavour further to extend their export trade with Italy, whilst the German manufacturers will put forth efforts to recover the trade lost during the period of hostilities. But as in various other countries so in Italy has a movement been started for securing freedom from Germanism. Indeed, the initial steps were taken two or three years ago by one of the leading banks which, finding Teutonic influence becoming rather irksome, adopted measures whereby the withdrawal was obtained of the German directors on the board and the leading German officials on the staff; and the present war has merely served to accentuate the desire further to eliminate Teutonic interests from the trade of the country. Our advisers in Italy have frequently affirmed that if British firms are to replace their hostile competitors a radical alteration will be necessary in their business methods. According to Mr. R. Bagot, who brought the question recently before the London Chamber of Commerce, the difficulties in the way of British firms are as follows:—

1. The high prices of British goods as compared with German articles of the same kind and of little inferior quality.
2. The use of English in correspondence, and English systems of coinage, weights and measures.
3. The failure to grant easy terms of credit and payment.
4. The lack of travellers.
5. The want of branches of any important English bank in the Italian cities and industrial centres.

Mr. Bagot has brought forward the problem from a general point of view, whilst the engineering standpoint was raised several months ago by an English engineer who has resided in Italy for a period of 10 years. Such a long term of years naturally enables a man to speak with authority in regard to the Italian market for machinery. This engineer, representing as he did a British engineering firm, does not go quite so far as Mr. Bagot does, perhaps, because, being on the spot, he was engineer and traveller combined, and could give quotations in Italian currency and weights and measures. What he states is that no English firms will be able to keep pace with the Germans unless they change their business methods in the engineering trade as well as in all other branches of trade, and that Englishmen never occupy the first place in Italy. The Germans, he declares, actually offer more for the money, and if the quality of their goods in some cases is less satisfactory this defect is equalised by their conditions of payment; and they accommodate themselves to Italian conditions in a manner which is rarely the case with Englishmen. The requirements are consequently cheap and good machinery and long credit, and in this connection surprise is manifested at the small percentage of bad debts incurred. If the Germans are entirely beaten in the war the engineer concludes that they will still remain a factor the importance of which cannot be under-estimated in regard to the Italian market. These statements deserve the serious consideration of those British firms who hope further to promote trade with Italy which is now anxious to shake off the German yoke for ever.

Russia and German Influence.

THE now well-known determination of Russian manufacturers to secure emancipation as far as possible from German industries has been followed by the adoption of preliminary measures by the legislative assembly in the same direction. For this purpose the Duma recently decided to appoint a Commission to inquire into the best means for combating the systematic penetration of Germany in all the departments of Russian life. The Commission has just met for the first time and settled its working plan by resolving to divide the labours among four sub-commissions. The first has been entrusted with the examination of all documents submitted to the Commission; the second has to deal with the German incursion into agricultural operations; the third with the contest against German monopolies in industry, commerce and finance; and the fourth with questions concerning the Baltic provinces. It will be obvious from the scope of the inquiry that the proceedings will be of a prolonged character, but with the assistance of the leading representatives of the industries concerned the foundation should be laid for the elimination of the German element from Russia. The most important problem from the Russian point of view, having regard to the past dependence upon Germany for the absorption of an enormous amount of agricultural produce, is the discovery of new markets for the products of her soil, as in that event the new markets would, or should, be able to send manufactures in exchange and thus tend to oust Germany from the Russian market. Failing these markets Germany in all probability will continue largely to monopolise the Russian import trade, in so far as the Russians do not help themselves by developing their own manufacturing industries, and thus rendering themselves more independent of commodities of Teutonic origin.

The Very Non-technical Press.

OUR contention that the lay Press would do well to include on its staff at least one member with a smattering of scientific knowledge was once more fully justified by a report which some of our daily contemporaries rashly published last week. It related to an Italian engineer, residing at Marseilles, who had "solved the problem of maintaining a body suspended in space absolutely motionless"; his apparatus "is four metres long, 75 cm. in diameter, weighs 95 kilograms, and can raise 45 kilos . . . it can remain for 24 hours in the air, and come down at a point 200 kilometres from its starting point." "The apparatus can be set in motion at a prodigious speed in any direction whatever, and can be stopped at any point, and all this is to be accomplished without any mechanical motive power, but merely with the use of the Hertzian waves. The principle of this invention, the telegram adds, is based on the special distribution of electric and magnetic forces," &c. The *Daily Chronicle* headed its announcement "Law of Gravity Set Aside." Certainly, as a practical joke on the daily Press it is not without a humorous aspect, but that is not what the *Chronicle* means.

Now, any fool engineer can see at a glance that this report is pure and unadulterated piffle—an invention indeed, but not a discovery. The statement is as fanciful and fantastic as Jules Verne's story of a journey round the moon, without, however, the basis of fact and feasibility which that gifted author always built upon. To the classical experts of the daily Press, whose scientific education has presumably been confined to the views of Aristotle and Archimedes, such fables present no difficulties; but they are supposed to educate the public!

If the editorial offices harbour no tame scientists, why do the Editors not avail themselves of the assistance of their technical colleagues? We speak not only for ourselves, but also, we feel sure, for the technical Press in general, when we say that an inquiry on the telephone as to the merits of such reports would be gladly answered, without a thought of remuneration; for we wish to see in the daily Press only the truth regarding scientific and engineering matters, and for this purpose our services are always at the disposal of our non-technical colleagues.

A MACHINE FOR SCALE-MARKING OF INDICATING INSTRUMENTS.

[COMMUNICATED.]

THE marking of scales for indicating instruments, such as voltmeters, ammeters, and wattmeters, &c., is usually carried out by hand, as it has been found that even identical instruments give slightly different characteristic curves which would render stereotyped printed scales too inaccurate.

In addition to this drawback, a tremendous number of patterns would be required, not only on account of the many ranges asked for by clients, but also because of the ever-growing multiplicity of sizes and shapes.

Now, it is a matter of experience that hand-marked scales are not always satisfactory, while their cost is a rather serious item in the labour bill of the individual instrument.

These considerations have led to the adoption by various makers of mechanical devices, in order to obtain better work, to reduce the cost of labour, and to turn out work more expeditiously than is possible with the old methods.

A common procedure in scale-marking, which is now very largely superseded, consists in putting a blank scale on the instrument, and in first of all marking the length of the pointer in three positions, so as to be able later on to find the centre of the circle of which the end of the pointer traverses an arc.

The next operation is to fix an evenly-divided and numbered auxiliary scale to the blank one on the instrument. Of course, instruments would rarely be taken singly; usually several dozens, or as many as possible of the same range, would be connected in parallel or series, according to whether volt or ammeters are being dealt with.

After the covers are put on, the instruments are properly levelled, and the zero positions of all the pointers, as shown on the auxiliary scales, as well as a sufficient number of convenient (calibrated) readings, are taken down.

From these data, which, for instance, for a 50-ampere ammeter, might be in the following form:—

Zero	...	2·5	30 a.	...	70·3
10 a.	...	15·2	40 a.	...	110·1
20 a.	...	33·7	50 a.	...	147·6

the blank scales on the instruments can be marked in pencil, and the draughtsman can now proceed to construct the scale according to the particular style adopted by his firm. He will first find the centre mentioned above, then trace the necessary concentric lines with compasses and pen, and after this sub-divide the scale.

This sub-division, at least in the case of instruments having quadratic characteristics, will be more or less guesswork, but this is usually considered near enough for practical requirements.

If a special accuracy is guaranteed for a certain part of the scale, it will be necessary to take more calibrated readings than we have mentioned for the sake of illustration, and to plot a curve from which intermediate points can be obtained.

The method outlined above has its obvious disadvantages, and one of the most important is that the calibrated readings taken by means of the auxiliary scale have to be marked on the blank, which means two possible mistakes, one in reading and one in marking, or, at least, the introduction of two small errors due to the human equation.

These errors are being added to by the draughtsman, so that the resulting scale may be out by more than is admissible, unless skilled and very reliable workers are employed. Such workers, however, are not too plentiful, and as mentioned before, reduction of cost being a desideratum, the utilisation of mechanical means becomes imperative.

Of the various methods in use, we propose to deal with one which only requires a skilled observer to take the calibrated readings, while all the other operations in producing the finished scale can be carried through by unskilled female labour. The method presupposes that all the instruments are standardised, especially as regards length of pointer, and that all scales of the same size and type are immediately interchangeable.

The difference from the old method starts with the first operation, inasmuch as no blank scales are put on the instruments. Instead auxiliary scales, which are standard in every respect as regards mounting, fixing holes, &c., but which are evenly divided into, say, 150 divisions, covering a sufficient angle, are used.

If the types of instruments dealt with in this fashion have been sufficiently developed, it will be possible to arrange for beginning and end of the scales to be in absolutely identical positions, and in such cases intermediate calibrated readings only need be taken.

When turning out large quantities, the data obtained when calibrating should be entered on printed cards providing space for all necessary particulars, and also, at least for some types of instruments, squares for plotting curves. These cards are indexed and filed for reference after the first set of scales has been completed.

We have now to describe the little machine which does this work with the help of the data supplied on the cards. The machine consists mainly of a turntable of sufficient diameter to take the largest scale to be made, and is provided with means to fix scales of various sizes and patterns.

The circumference of the turntable is divided in a convenient number of divisions, say x, which are marked from 0 to x. The turntable can be rotated by means of worm and wheel, the ratio being so chosen that, say, $1/x$ revolution of the turntable—that is, one division on the scale—corresponds to one complete turn of the worm. By arranging a wheel on the spindle carrying the worm, and dividing the circumference of this wheel into 10 or 100 parts, one or two decimals can easily be introduced, and, if backlash is properly guarded against, and indices (on the circumference of the turntable and the wheel) are provided, it is possible to reproduce any particular position of the turntable any number of times with a high degree of accuracy.

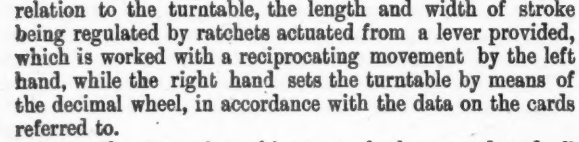
Over the turntable, in the direction of a diameter, the tracing or printing apparatus is suspended. It is fixed to a bracket connected to the base on which the turntable is pivoted.

In the case of a pen being used, this can move radially in relation to the turntable, the length and width of stroke being regulated by ratchets actuated from a lever provided, which is worked with a reciprocating movement by the left hand, while the right hand sets the turntable by means of the decimal wheel, in accordance with the data on the cards referred to.

In another type of machine type-wheels are used, and all strokes forming divisions and sub-divisions are actually printed.

The auxiliary scales mentioned are all produced on the machine, and with care it is easy to arrange several machines in such a way as to make the scales turned out on them interchangeable.

There remains to explain how the sub-divisions are obtained. To this end a transparent slide is utilised, which is divided as shown in the illustration below, and, further, a movable index is pivoted in the centre of the turntable and is capable of being fixed in any point to the scale of the latter.



Division of Transparent Slide.

The slide shown above would be suitable for subdividing into 10 equal divisions, and is so arranged that it can be exchanged at a moment's notice for another one. This provision is useful if different types of instruments are dealt with by the same machine, as it is then easy to use slides divided according to the particular characteristic curve of each type.

The slide is movable in the direction of the arrows, and perpendicularly in relation to the plane of the turntable. The distance between 0 and 10 must be slightly more than the longest distance—to be sub-divided into 10 divisions—between two calibrated points on any scale likely to be wanted.

Using the data given in our example, we will now proceed to print a scale on the machine.

The first operation is to fix a blank scale to the turntable. The machine having been adjusted beforehand to obtain the proper lengths and widths of strokes and to ensure the latter being in the right position, the operation to follow would be to determine the zero. This, in our case, is at 2·5 of the turntable scale, and the decimal wheel is turned until the indices indicate exactly this position. Now the first stroke is printed by pulling the respective lever, care having been taken that the ratchets governing length and width of stroke are properly set.

The next point to be marked is, say, 10 amperes, situated at 15·2, and its location is found by turning the decimal wheel accordingly.

As from this point our scale is to be sub-divided to 1 ampere, the slide now comes into action.

The vertical (zero) line of the slide will be found on 15·2, and the slide is now moved vertically until the slanting line 10 passes through point 33·7 on the turntable scale. For greater accuracy in reading, the use of a magnifying glass is advisable (as in Kelvin balances).

The distance from 15·2 to 33·7 is, through the foregoing operation, divided into 10 equal sections, and the corresponding strokes can be printed on the scale. To this end the movable index referred to is fixed on 33·7, then the decimal wheel is turned until the slanting line 9 coincides with the movable index, when the first sub-divisional stroke can be printed. This done, the decimal wheel is again turned, and the process mentioned repeated with slanting line 8, and so on until all sub-divisions are formed.

The next interval 33·7—70·3 dealt with in the same way, and so forth, until the scale is completed.

The concentric lines, also the figures and the wording, can either be printed by hand or, if the quantities warrant it, stocks of stereotyped printed scales, either paper covered or enamelled can be kept. Of course, zero and end position only would be marked on these scales.

In the case of engraved scales the engraving tool or tools are worked direct by the machine, or where chemical engraving was resorted to, the tracing would be done by means of a pen (on the machine), and the ink used would have to be capable of withstanding the acid in the subsequent etching process.

The machine and method outlined are also applicable with slight modifications to transparent scales and to edgewise instruments. Of course, the machine itself can do nothing; a very carefully thought-out organisation is required, but given this, the results obtained are remarkable.

The present writer found it possible to work the whole scheme with girls, and it was really astonishing to see how quickly, under proper instruction, they developed into reliable workers.

The system of instruction followed was to show every operation down to the minutest detail, exactly in the form which experience showed to be the quickest and most efficient, and to insist on its being invariably followed. Workers who could not, or would not, suppress extra turns of their own, if it were ever so slight a deviation from the regulation procedure, would be given other work or dismissed.

The advantages of the system of scale marking outlined above are important. Not only can unskilled female labour be employed throughout (with the possible exception of the taking of the calibrated readings), but the results are much superior to those obtained with the old method.

The accuracy is obviously much greater, since calibrated readings are only taken once, so that the human equation is only introduced once; all other work is purely mechanical, and can be rendered as accurate as may be desirable.

One of the chief merits of the system is undoubtedly that

a permanent record of all scales and their accuracy is obtained (the checkers putting their remarks conveniently on the original calibration cards), which affords a continuous control over the instruments turned out, and is most helpful in case of disputes, or when considering alterations or improvement of types.

This permanent record, properly filed, also makes it possible to reconstruct any scale at a moment's notice, a contingency which may arise at any time, but which usually means a return of the instrument in question to the works.

The present writer remembers cases where, in order to save duty, large quantities of instruments and scales were sent as separate consignments, and where not infrequently the scales, being packed in a very small case, were mislaid or lost in transit. In those cases it was very much appreciated both by maker and client that there was no need to return the instruments, but that new scales could be shipped out practically by the next boat.

INSURANCE AGAINST HOSTILE AIRCRAFT.

[BY OUR LEGAL CONTRIBUTOR.]

Many of the daily papers have recently dealt with the all-important question of insuring against damage caused by hostile aircraft. No doubt most prudent readers of the Electrical Review have insured long ago without pausing to inquire whether, in the event of disaster, the liability to make good the damage was upon them or their landlords; but there may be others who are still hesitating. With a view to showing how necessary it is to be guided by the maxim, "When in doubt, *insure*," it is proposed to consider the legal aspect of the matter.

The case of the freeholder is simple enough. The Government has declared that since the scheme of State insurance was inaugurated, compensation for damage caused by bombs will not be paid by the State. For the freeholder, then, the question is: "Shall I make a small money payment, and get an insurance company to bear the burden, or shall I be my own insurer?" It is said that one of the victims of the recent raid upon the "London District" had stoutly refused to take out a policy, on the ground that the chance was 1 in a 1,000,000. On the day after the raid he found that an unlucky bomb had made him a ruined man!

In the case of a limited liability company it is beyond question the duty of the directors to insure. It is true, as was stated in the case of Overend & Gurney *v.* Gitt ((1872) L R 5 H L, 480) that "facts which may show imprudence in the exercise of powers clearly conferred upon directors will not subject them to personal responsibility unless the imprudence amounts to *crassa negligentia*;" but where there is insurance available at Government rate, it is obvious that no director could be charged with extravagance in laying out the necessary premium. Even if his failure to do so fell short of negligence in law, he and his co-directors would have a very uncomfortable quarter of an hour at the next shareholders' meeting should the premises of the company be destroyed by one of the products of German "Kultur."

Coming next to the cases where the incidence of liability may present some difficulty, one has to consider the respective positions of landlord and tenant. Unless there is a covenant "to repair" or "to yield up in repair," it is obvious that the loss must fall on the landlord. On the other hand, it was laid down in the middle of the seventeenth century that where a lessee undertakes without qualification to keep premises in repair during the currency of the lease, he is liable if they are thrown down by enemies. In Paradine *v.* Jane ((1647) Aleyn, 26), it was stated that: "Where the party by his own contract creates a duty or charge upon himself, he is bound to make it good, if he may, notwithstanding any accident by inevitable necessity, because he might have provided against it by his contract. And, therefore, if the lessee covenant to repair a house, though it be burnt by lightning, or thrown down by enemies, yet he ought to repair it."

So stands the law as it affects 99 out of every 100 lessees in this country. The ordinary fire risk is generally covered by a policy taken out by the landlord, the premium being paid by the tenant; but it is now a matter of notoriety that the ordinary fire policy is not so framed as to make the company liable for the damage done by an incendiary bomb.

The modified repairing covenants which appear in some leases merit a few words of explanation. Suppose, for example, that the following words occur:—"Reasonable wear and tear and damage by fire alone excepted." It has been held that the words "reasonable wear and tear" do not extend to relieve the tenant from responsibility for damage caused by overloading the floors of a building. So (or, rather, *a fortiori*), it is conceived that these words would not excuse the tenant from liability to make good the damage caused by a bomb. As to a fire caused to premises which are the subject of a lease containing such a clause, it is conceived that the tenant might possibly escape liability from the results of a fire howsoever caused.

With regard to rent due and accruing while premises are being reinstated, it is important to remember that the tenant's liability to pay rent remains, and in taking out his policy of insurance he should remember this important fact.

The purely legal aspect of the matter has been considered above. Broadly speaking, the tenant is liable and should insure; but the landlord must consider the matter from his point of view. True, if the premises are destroyed he has a claim against the tenant; but will it be worth anything? With the premises, the tenant's stock-in-trade and goodwill may be entirely destroyed. There will be nothing left on which the landlord can issue execution. He will have nothing but a lawsuit on his hands. It is therefore prudent for every landlord either to satisfy himself that his tenant has insured, or else take out a policy himself.

There remain a few minor points to consider. When deciding the amount for which a policy shall be taken out, the business man—say, a dealer in electrical fittings—has much to consider besides the actual value of his stock-in-trade. He has, upon his premises, numerous files of correspondence intrinsically valueless but indispensable for his business. A barrister or a doctor may carry his business in his head; but the commercial man cannot do so. He should, therefore, insure against the prospective loss which he must inevitably suffer if his premises are destroyed.

With regard to electric lighting companies a few words may be added. In the first place, it is conceived that the suspension of supply owing to the wreckage of a generating station would be due to *force majeure* or inevitable accident, which would absolve the company from continuing to give a supply. In other words, they could not, in such circumstances, be made liable to penalties even if a whole town were plunged in darkness. Insurance, however, of the entire undertaking would undoubtedly be prudent, and the policy should be framed so as to cover the prospective loss of consumers during the period of restoration.

Finally, care should be taken to see that the policy is in the same terms as that approved by the Government, in that it insures against damage done by hostile aircraft *and* by projectiles fired at them. Recent events have shown that anti-aircraft guns do not always hit the marks at which they are aimed; and an English shell crashing through the roof is almost as unwelcome a visitor as the very latest product of fiendish Teuton ingenuity.

Fire.—Considerable damage was done at Redford Barracks, Edinburgh, by the destruction by fire of the machinery shed and a quantity of plant, including dynamos and motors, belonging to Mr. C. Macandrew, builder.

Panama Exhibition.—Messrs. Worsnop & Co., of Halifax, have been awarded a Gold Medal at the Panama Exhibition at San Francisco for their exhibit of electric hand lamps, electric miners' lamps, motor lamps, self-starters for motor-cars, and for their "Alklum" accumulators.

LONDON AND SOUTH-WESTERN RAILWAY ELECTRIFICATION.

The decision of the directors of the London and South-Western Railway Co. to adopt electrical working on their suburban system was announced about three years ago, and some particulars of the scheme—one of the most important in this country—were given in our issue of December 13th, 1912, which were amplified in the following year (November 7th, 1913), when the work was put in hand. As then set forth, the complete scheme embraced the network of lines extending from Waterloo station to Hounslow, Shepperton, Guildford, Epsom and Wimbledon, a total length of 246 miles of single track, but in the first instance the conversion of about 47 miles of route, equivalent to about 140 miles of single track, has been undertaken, the lines which are being electrified being shown on the accompanying plan (fig. 3). The system adopted was direct current at 600 volts with a third-rail conductor, this enabling traffic to be exchanged with the Metropolitan District Railway. The company decided to generate power for itself, and has put down a power station alongside the railway at Durnsford Road, near Wimbledon, which is now practically complete; a view of the exterior is given above. The electrification of the lines is also approaching completion. The work has been carried out under the supervision of Mr. H. Jones, the company's electrical engineer; Sir Alex. Kennedy and his partners are consulting engineers to the company.

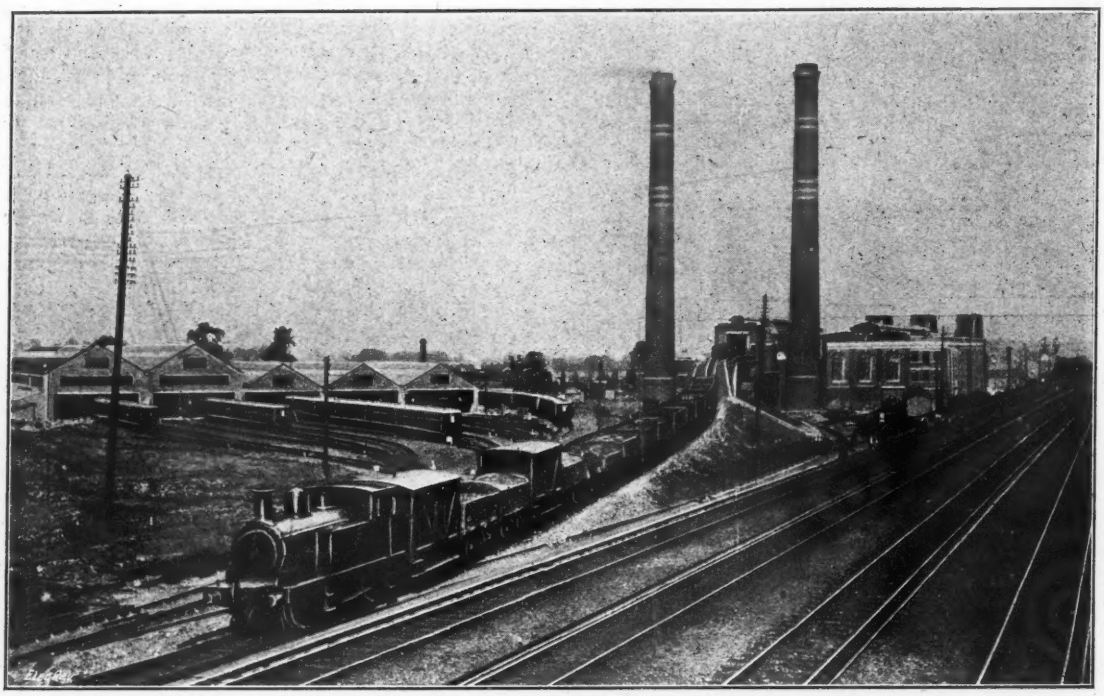
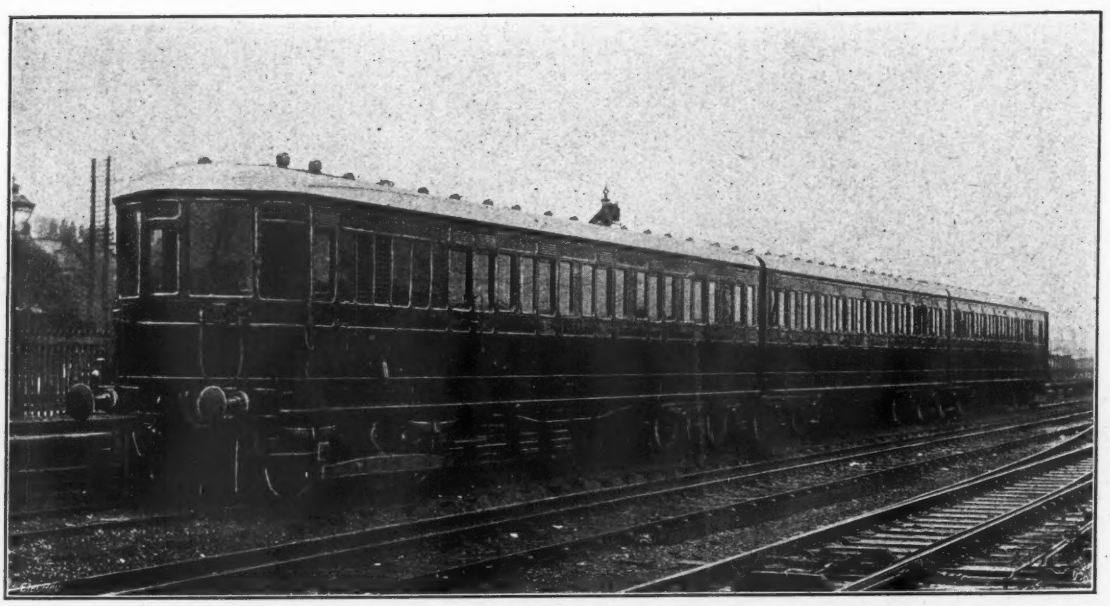


Fig. 1.—Power House, Car-Shed, and Main Line of the London and South-Western Railway Co.



Photos by] Fig. 2.—L. and S.W. Railway Three Coach Electric Train. [Topical Press Agency.

The trains are equipped for multiple-unit working, and are made up in three-coach units, each set consisting of two

motor coaches with a trailer coach permanently close-coupled between them; these sets will be used alone or made up into six-coach units in accordance with the requirements of the traffic. One of the sets is illustrated herewith. The original rolling stock has been employed, with compartments and side doors, the necessary alterations being made to accommodate the electrical apparatus. Each set is provided with four motors of 275 H.P. each, arranged in pairs on the bogies under the driving compartments at each end of the set, and all the electric controlling gear is placed in these compartments instead of beneath the coach, the company's engineers preferring this arrangement for the sake of the greater ease of access for inspection, cleaning, and adjustment.

The power station is adjacent to the River Wandle, from which water is obtained for condensing purposes. Two ferro-concrete ducts bring the water to the station and return it to the river. During periods of prolonged drought the supply of water from the river will be insufficient, and at such times a part, or the whole, of the circulating water will be pumped

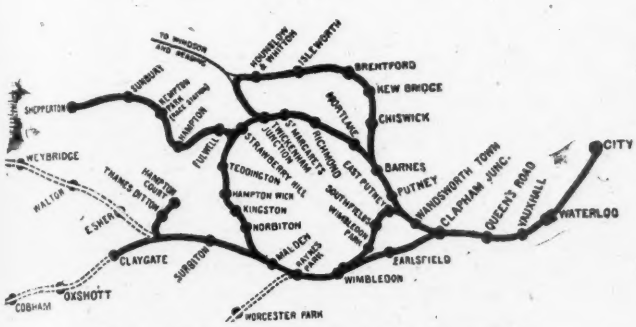


Fig. 3.—Plan of Lines now being Electrified.

over cooling towers, the tops of which may be seen in our view.

The formation of the ground, which slopes from the railway towards the power house and the river, has greatly simplified the coal-handling arrangements; it has been found practicable to dispense with all the usual coal-conveying plant, and to discharge the coal from railway trucks directly into overhead bunkers in the boiler house. The viaduct constructed for this purpose, which may be seen in the illustration, is for the greater portion of its length provided with open decking, so that coal can be discharged from the trucks directly on to a reserve storage space under the viaduct; this space, which is bounded by a low retaining wall, has a storage capacity of about 10,000 tons of small coal. As the ashes are drawn from the boiler-house basement into an overhead receiver outside the building by means of a vacuum system, there are no coal or ash conveyers of the usual type throughout the station. The viaduct is 550 ft. long and 19 ft. wide, and is constructed of ferro-concrete with the exception of a 50 ft. steel girder span.

The power station, which will eventually supply power for the whole of the company's suburban system, is a brick building; the boiler house, which runs parallel with the turbine house, is 237 ft. long × 130 ft. wide, while the turbine house is 257 ft. long × 55 ft. wide, and is capable of accommodating plant of 30,000 KW. output.

The generating plant at present installed consists of five main and three auxiliary generating sets, with space for a sixth main set to be installed when required. The main sets are turbo-alternators of 5,000-KW. capacity and generating three-phase current at 11,000 volts, 25 cycles, while the auxiliary sets generate direct current at 220 volts for lighting and power.

Repair and inspection shops for dealing with the electric trains have been built close to the power house, and there are nine sub-stations on the railway, where the supply is transformed down and converted to direct current at 600 volts.

(To be continued.)

METAL SPRAY PROCESSES IN ENGINEERING.

By JOHN CALDER.

(*Abstract of paper read before the* American Society of Mechanical Engineers.)

It is the object of this paper to describe the latest mechanical process, the Schoop process, for depositing electro-positive metals on iron and steel. Incidentally, the method permits the depositing of many other metals and alloys on coherent bodies whether metallic or not.

The process takes its name from M. U. Schoop, an engineer of Zurich; who, in collaboration with other inventors, made the metal spray an effective coating agent. In the Schoop process, for which the United States patents have just been issued, the coating metal adheres to the object chiefly by mechanical union. The metal is discharged in hot impalpable particles moving with high velocity, and these when directed upon a prepared object penetrate the pores of the latter while the spray is still plastic. The coating metal thus dovetails itself into the superficial pores of the object, and does so in the presence of reducing gas which prevents oxidation at the junction of the metals.

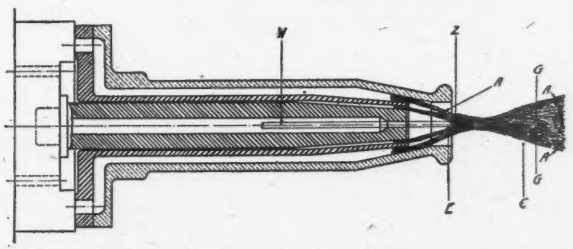


Fig. 1.—Diagram Illustrating Application of Reducing Flame to Metal Wire in the Pistol.

The evolution of the apparatus has been interesting. The liquid metal process involved a large non-portable reservoir of hot metal weighing, with the auxiliary parts, over a ton; the metal dust apparatus weighed over 100 lb., while the "pistol" of to-day weighs less than 4 lb.

The principle involved consists, as shown in fig. 1, in feeding a fine wire W of any metal into a reducing flame zone Z at such a constant speed that the position of the end of the wire E remains stationary, the melting rate being exactly equal to the rate of feed. Under such conditions the wire end melts a drop at a time and each drop at the instant of formation is struck a violent blow by an air blast A. In other words, the pistol is a machine gun which automatically manufactures its ammunition from a reel of wire and bombards the objects to be plated with plastic projectiles of extremely small size.

The resulting fog or spray of fine metallic particles into which the drops are divided takes the form of a diverging cone C with a core of reducing gas G in which the particles are entrained, and a surrounding sheath of air A which is rapidly expanding and cooling. Any suitably prepared object placed in the path of this metallic spray is plated through impact without undue elevation of temperature.

Fig. 2 shows a section of the commercial spraying pistol now in use. The principal parts of the pistol consist of an outer casing A_1, cast of aluminium, with a central projecting tube forming a handle, a wire feed mechanism mounted entirely upon the cover B_1 of the turbine chamber, the turbine C_1 actuating the wire feed mechanism, gas, air, and wire nozzles mounted upon the outer casing held in position by a hand nut D_1, and a removable cover F_1, which completes the enclosure of the outer casing.

Gas and air ducts are drilled in the outer casing. The flow is controlled by the tapered valve F provided with a handle G. The wire feed mechanism is actuated by a turbine C_1 mounted on a vertical shaft running in ball-bearings; a worm is cut in the upper end of the vertical shaft and drives by worm wheels the horizontal shafts N and O (inset), which are provided with worms in turn driving the worm wheels P and Q

The wheels P and Q, fig. 2, are provided with slots to engage the projecting lugs of the lower feed wheel R. The upper feed wheel S, mounted in the pivoted frame T, is provided with shrouds controlling the position of the lower feed wheel R. The lower feed wheel can be engaged in either worm P or Q by raising a clip I, shifting laterally in either direction and locking in by the opposite clip. The shift can be readily made by allowing the mechanism to run slowly by a slight opening of the starting valve.

Pressure is applied to the feed wheels through the pivoted frame T by a coiled spring, and controlled by the operator by means of the release lever K. The final adjustment of the wire feed is controlled by the needle valve M. The turbine and shaft complete is assembled in the outer case and properly adjusted independently of the other mechanism.

The wire feed is entirely assembled on the turbine cover and, when properly adjusted, is secured in position. The wire nozzle base U provides an adjustment for position of wire and gas nozzles,

and is secured in position by a headless set screw. The upper end of the stem of the turbine cover is provided with an annular groove, which is engaged by the spring loop V and secures the removable cover E_1 of the case. Loop V provides also a means for hanging the pistol on a conveniently located hook.

The operation of the pistol is as follows: The gas and blast nozzle faces B and C are securely clamped to form gas-tight joints by tightening the hand nut D_1. The end of the central or wire nozzle is then 0·015 in. inside the gas nozzle, and the stationary melting point of the wire is 0·03 in. inside the air-blast nozzle. The wire diameter used is from 0·0319 to 0·0375 in., except for lead and tin which are used in larger sizes owing to their rapidity of melting.

The feed gears having been set in mesh at the approximate speed required for the wire selected, the air alone is turned on and the speed tested with a short length of wire. Adjustment, if necessary, is made by the needle valve, which modifies the speed 2 ft. per minute plus or minus.

The end of the wire reel is then threaded through the stock receiving tube, between the gripping feed rolls and into the central wire nozzle, and the fuel gas pressures from the containers are adjusted by the reducing valves and gauges thereon to the tabular requirements for the metal to be sprayed. The pressures of the fuel gases seldom rise above one atmosphere, and hydrogen or Blau gas are the reducing gases usually employed. This gas is now admitted by slightly opening the starting valve, and when ignited with a match burns quietly as a pilot light.

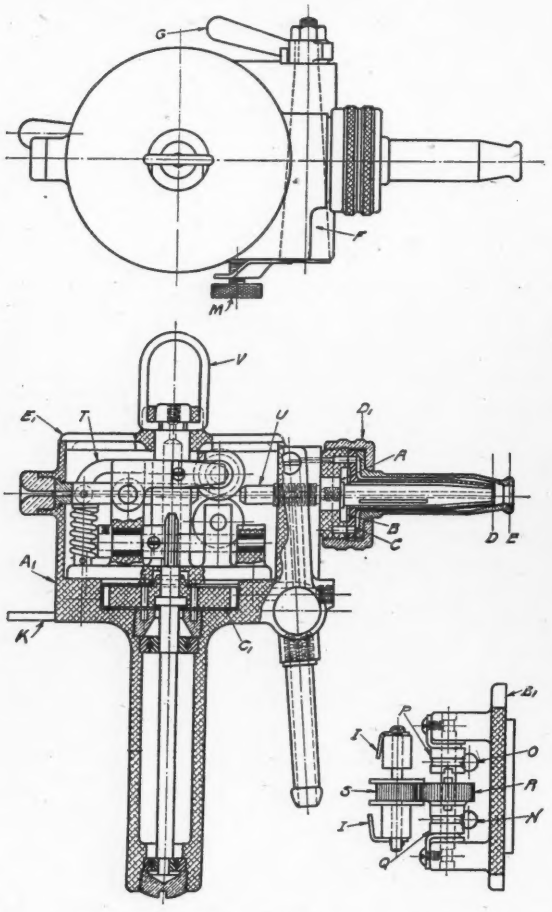


FIG. 2.—DETAILS OF THE COMMERCIAL METAL SPRAYING PISTOL NOW IN USE, SHOWING TURBINE, WIRE FEED MECHANISM, &C.

The starting valve is then opened up full and oxygen is admitted gradually until the flame zone is established. All back-firing is avoided by keeping the reducing gas always in excess of the oxygen, the ratio being three or four to one. The above movements are made in rapid succession on a light instrument which can be held in one hand, and the spray is started up the moment the constant melting position of the wire is reached.

The spray so established is essentially a metal plating air-brush, the diameter of which, 5 in. from the pistol end, is about 2 in. Objects to be plated are operated upon by pointing the pistol normally to the surface to be coated at any moment at about 5 in. distance, and traversing the pistol across the surface with a regular motion. A single coating is about 0·001 in. thick. The operator's vision easily guides him in distinguishing between the coated and uncoated portions, and also between a first and second coat.

Two thousandths of an inch well impacted upon a surface are just as effective as a much greater thickness, and, of course, unnecessary sprayed metal increases the cost, as the latter is directly proportional to the thickness. Not only on the score of economy, but also to preserve toughness, the coating should be of minimum thickness, for the anvil action of the metallic spray on a solid metal object is lost above a few thousandths of an inch thickness, and a process of cold working follows, which produces a brittle scale readily detachable. In practice this matter is easily regulated.

Fig. 3 shows the pistol held in the hand ready for action, with the wire thread in position.

Gas bombs with fittings and air at 40 lb. pressure are the only requisites besides the pistol and its hose connections for plating non-metallic objects such as wood, stone, paper, cement, cloth, &c. All metallic surfaces should have the scale cleaned off, and their pores opened by preliminary sandblasting.

A surface 1 sq. ft. in area can be sprayed with the common metals, 0·001 in. thickness, for a small sum. The total cost for German silver is 3½ cents, for copper 3 cents, for tin 5 cents, for brass 2¾ cents, for zinc 2 cents, for aluminium 1¾ cents, and for lead 1½ cents per sq. ft.

Except in the few cases where the impacted metals have a chemical affinity, the action of the spray is purely mechanical. Any metal wire can be sprayed with varying degrees of fineness by the pistol, but a hard metal, such as copper, cannot be impacted with the same degree of adherence upon a solid copper object as it would be upon a more porous cast-iron object or upon one of the soft metals such as lead or zinc. The coatings may be ground, polished and buffed like any ordinary metals, but polished sprayings do not offer themselves as economical substitutes for cheaper and less adherent platings which are deposited in smooth condition.

The applications of the process already made are numerous, and new ones are being suggested continually. In this connection it should be noted that, though coatings of all the commercial metals and of their alloys can be made on any other metal, and on almost any coherent object, except articles containing grease, the choice of a metal coating should be conditioned by the service which it has to render.

Spraying a metal so that it plates an object gives the coating metal no chemical properties it did not possess before. Hence sprayed coatings used for protective purposes, rather than for finish or decoration, are restricted for resisting acids to lead, for resisting air, moisture, sea water, and ordinary atmospheric action to lead,

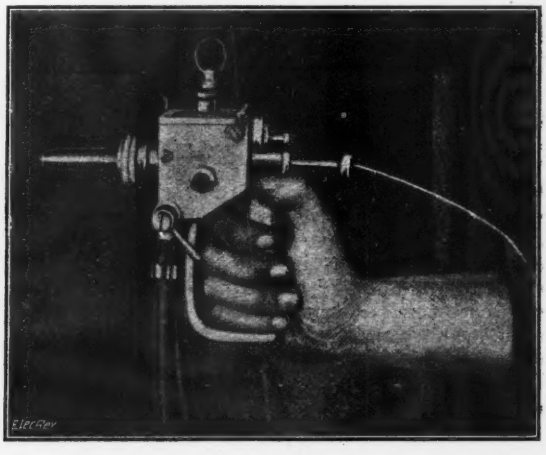


FIG. 3.—VIEW OF A COMMERCIAL SPRAYING PISTOL IN HAND READY FOR USE.

tin, zinc and aluminium, and where superficial oxidation of the coating is of no importance, copper and its various alloys can be freely used also.

Protective coatings on steel or iron may be either original coatings of the whole of an object, or any part of it, or local applications with the pistol to repair damage or wear of a coating made by another process. The repair of the troublesome defects on galvanised sheets is an example. The localisation of copper deposits on iron and steel for the purpose of the cementation process, and for controlling hardening, is easily and quickly accomplished by the pistol. The results are reported to be much better than those obtained from the necessarily irregular and soft electrolytic deposits, the area of which cannot be absolutely controlled.

Many engineering structures used in the arts, such as steel and iron tanks, girders, and machinery of all descriptions, are subject to the action of liquids and chemicals, and corrode rapidly, particularly at joints. It is not possible to plate such structures by any other coating method. In such cases, a metal is selected which will resist the corroding agent, and is sprayed on all the seams and joints, these having previously been cleaned by sandblasting. In many cases the treatment of the joints is sufficient, the solid metal resisting oils and liquors for a long time when the seams are rendered free from attack. Railroad and bridge girders can be handled by portable outfits to protect them from the atmosphere and moisture. This is a large industrial field of application in which lead, tin, and zinc sprayings are used, and proper initial treatment of this kind, or in the field during erection, dispenses with all need for repeated painting.

Laundry machinery, dairy appliances, water-heaters and similar structures exposed to moisture and chemicals, can be protected against corrosion due to electrolysis in many cases by sprayed deposits of zinc suitably located, or may be wholly tinned or galvanised by the Schoop process.

Carbon can be freely sprayed with copper, and that metal can be applied in minimum quantity to any piece or portion of a piece of apparatus.

The most recent electrical application is the construction of condensers, especially for wireless service. The Schoop pistol will spray an adherent coat of copper on ordinary sand-blasted window glass. Two-thousandths of an inch is sufficient to produce a highly efficient and cheap plate, much superior to rolled tin-foil coverings or galvanic deposits of copper on glass. Lead sprayed on glass also furnishes a very cheap and effective condenser plate.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Electric Tire Heater.

Taking advantage of the properties of the transformer, the Oerlikon Works have devised a convenient and useful apparatus for electrically heating tires, hoops, toothed gearwheels, &c., which have to be shrunk on. The usual method of heating such rings with coke fires, &c., is apt to result in a temperature far from uniform, and the parts have to be cleaned before they can be put in place; gas rings necessitate the use of compressed air, and the rings have to be of different diameters to suit the work.

In the Oerlikon device, which is illustrated herewith, the ring to be heated forms the secondary of a transformer, the yoke of which can be turned aside, as in fig. 1, to admit the ring, and afterwards clamped in place, as in fig. 2. The winding of the primary is protected from the heat by a stout layer of asbestos,

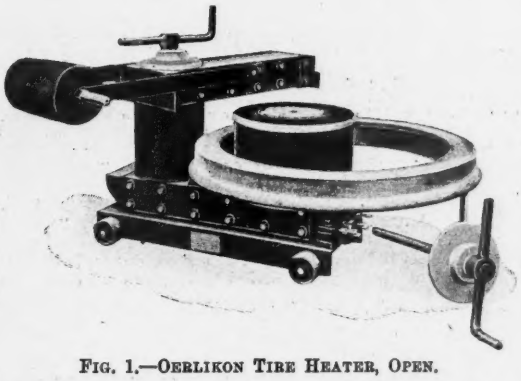


Fig. 1.—Oerlikon Tire Heater, Open.

and is confined to one of the cores, preferably the one interlinked with the work. The yoke is balanced by a counterweight pivoted at its centre, in such a way that it can be turned over to the opposite end, enabling the yoke to be swung round on the wound core, so that rings of too small diameter to go over the winding can be placed on the unwound core. The coils are provided with terminals to permit of the use of different sections in accordance

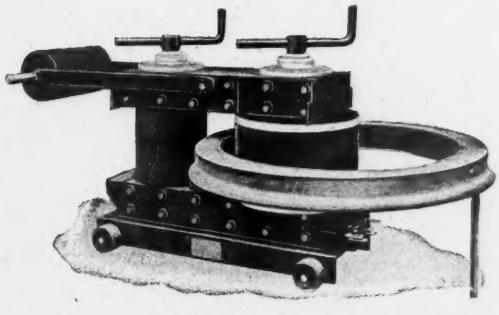


Fig. 2.—Heater in Use.

with the dimensions and material of the ring to be heated, and the rate of heating desired; in the case of metals of low melting point, such as lead or white metal, careful regulation of the temperature by this means is necessary.

The "shrink" required for a steel tire is from $\frac{1}{1000}$ to $\frac{1}{1500}$ of its original dimensions, and in the case of a tire 700 mm. in diameter, an increase of 3 mm. in diameter is sufficient to enable it to be put in place, which is obtained by heating it to about 150° C. Such a tire, weighing 120 kg., was heated from 15° C. at different rates, with the following results:—

Time in minutes	9	35	180
Power consumed, KW. ...	17·2	6·2	2·2
Energy, KW.-hours	2·58	3·62	6·6
Temperature attained ...	146° C.	111°	127°

Evidently, therefore, it is economical to heat the metal quickly. The device weighs 400 to 440 kg. The tire is heated quite uniformly, and may be of any size that will go over the core and into the space between the cores; straight bars, &c., can also be heated, by connecting the ends with a bare copper cable or other conductor.

Another use to which the apparatus can also be applied is the removal of tires, which are heated by using a copper cable as the secondary and connecting it to opposite points of a diameter of the tire. In use it is said to be more economical than gas heating.

For the foregoing information we are indebted to *La Revue Electrique.*

Revolving-Disk Grate Stoker.

Automatic stokers of the travelling-grate type, equipped with revolving disks in place of chains or grate-bars, in order to allow good draught without danger of melting parts of the grate, are being manufactured by the Keystone Stoker Co., of Boston, Mass. The grate surfaces of these stokers are composed of closely spaced disks

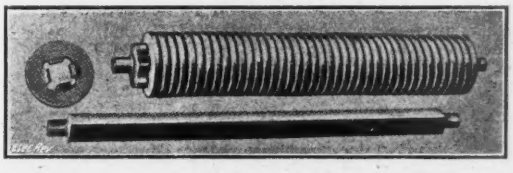


Fig. 3.—Grate Bar, Showing one Disk and Complete Unit.

mounted on parallel square bars, which rotate as they move through the furnace. The disks do not mesh, and they make two or more revolutions during one passage through the furnace, thereby causing the disks to be cooled by the air currents entering the fuel-bed. As a result, the manufacturer claims that the disks have no tendency to melt, and that the fire is gently agitated in a way which aids combustion and prevents mass formation of the clinker.

The links are made with flat bottoms, which enable them to ride on the rollers with a minimum amount of friction. Each link carries an umbrella-shaped shield cap, which protects it from the fire, the shields being held in place by dovetailing into grooves in the link. These shields form the upper half of the bearings of the bars carrying the disks, and afford a quick means of replacing the bars by slipping them out of the links.

Rotating the bars while in the furnace is effected by pinions fitted to one end of the bars, and engaging with rack teeth suitably spaced along the bearer-bar, which is also fitted with the rollers that support the links, as shown in fig. 4. The freshly-supplied fuel that sifts into the ash-pit is reclaimed by falling on an apron, and being carried forward by the returning disks on to a foot-plate at the front, as shown in the section of the stoker.

The coal enters under a gate which regulates the fuel supply. Circulating water-boxes are provided at the feed-gate and at the

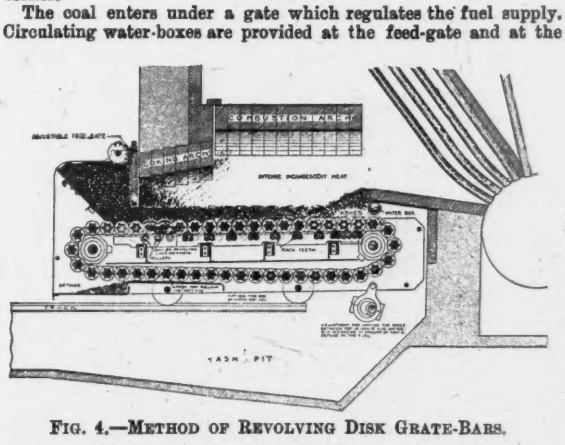


Fig. 4.—Method of Revolving Disk Grate-Bars.

bridge wall to prevent fires occurring in the coal-hopper and damage to the bridge wall. Dumping grates at the rear are eliminated, provision for raising or lowering the back end being made by strong eccentrics, which jack the stoker to thicken the fire at this point. In this way an excess of air through what would otherwise be the thin portion of the fire is prevented.

Since the fire disks revolve, the tendency for clinkers to stick to the grate is avoided, with the result that there is no serious plugging of the air spaces. The continual movement of the grate keeps the fuel even and in a free state, with the result that high draught pressure is not necessary to develop high rates of duty. The fuel disks and shields are common castings, so that the renewal expenses are low.—*Electrical World.*

Line Conductor Clip.

The awkward problem of attaching a heavy overhead cable securely to a porcelain insulator has taxed the brains of many an engineer, with results not always satisfactory; a simple device for this purpose has been introduced by Messrs. Bullers, Ltd., of 6, Laurence Pountney Hill, E.C., which appears to get over the difficulty, and has been adopted by several large companies on their transmission lines in this country and abroad. It consists of a clip of copper or aluminium strip (according to the metal of which the cable is made), which embraces the head of the insulator and provides for securely clamping the conductor in position. It can be fixed without special tools other than a screw-driver or pocket wrench, and can easily be detached and used again. By the use of strip metal of high tensile strength the weight and cost are reduced, as compared with clamps of cast metal, and the clip possesses a degree of flexibility sufficient to prevent the crystallisation of the conductor at the point of attachment, which is liable to occur if rigid castings are used. The clips are mechanically very strong, and can be supplied at short notice to suit all insulators and sizes of conductors.

An Automatic Cooker.

The idea of an electric oven with automatic temperature regulation is familiar to us, but rather as an ideal to be aspired to than as an actual achievement. A letter which appears in our "Correspondence" columns to-day, however, brings it before us in the latter aspect, and we illustrate herewith the oven to which the writer refers. The basis of operation of the apparatus is the maintenance of a temperature between 220 and 250° Fah., in which respect it differs fundamentally from the "fireless cooker," the temperature of which is continually falling. It was demonstrated by Mr. Gumaer, in the paper referred to by our correspondent, that cooking can be efficiently carried on at a temperature below the boiling-point of water, provided that sufficient time is allowed for the purpose, and the automatic oven operates on the principle of low temperature for a long time, in which respect it is, we believe, unique. The food is prepared and placed in the oven at any convenient time; the time switch is then set for the hour at which the cooking is to be commenced, and the main switch is closed, after which no further attention is required until the cooked food is removed from the oven in due course. This mode of operation enables the housekeeper to prepare the evening meal in the morning, and to leave the house all day, with the comforting assurance that a perfectly cooked hot meal will be ready on her return. As the temperature is low, and the oven is completely closed, vegetables, meat, sweets, &c., can all be put in together, and left in for the full time required for the longest operation, without spoiling those dishes which are cooked in a shorter time. The heat losses are reduced owing to the low temperature, and it is stated that an actual test showed that during three hours' use the current was on for less than 35 minutes in all, the energy costing less than 2d. at a price of 5d. per unit.

Fig. 5 shows the exterior of the "C" type cooker, which is provided with a hot-plate on either side of the oven. The hot-plate

Fig. 5.—Style "C" "Good Housekeeping" Electric Cooker.

heating elements are of nichrome wire, with two heats, and can be renewed by anyone at a very low cost. The cookers are guaranteed for three years, and the oven heating elements are renewed, free of charge, if they burn out on a voltage within 25 volts of the standard pressure. The hot-plate elements are guaranteed for one year. It is also guaranteed that the energy consumption will not exceed 100 watt-hours per pound of food cooked.

The shell is of polished steel, with cast-iron ends, &c., nickel-plated over copper. The insulating materials are mica and glass, and are tested, after completion, with 1,000 volts. Mineral wool and ground cork are used as thermal insulators. As shown in the cross-section, fig. 6, there are two copper jackets forming a double-walled steam chamber, and electrically welded together at the joints; between the jackets is contained a small quantity of water, and the rest of the space is exhausted of air. A phosphor-bronze buckled diaphragm is attached to the bottom of the oven. The heating elements are placed directly under the outer copper jacket, and when energised convert the water into steam, which distributes the heat uniformly throughout the space around the cooking vessels; when the temperature reaches 250° F. and the steam pressure about 15 lb. above atmospheric pressure, the diaphragm changes its shape and presses a loose pin down, which opens the switch contacts and turns off the current. When the temperature has fallen to 220° F. the diaphragm returns to its former position, and the switch

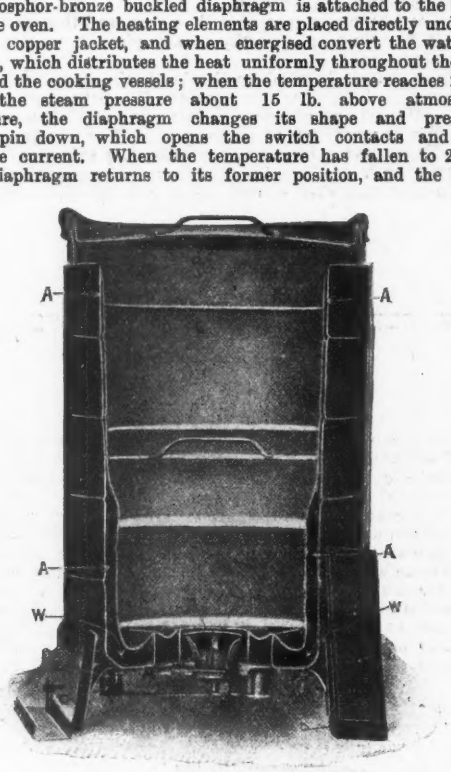


Fig. 6.—Section of Cooker.

A-A-A-A.—Double walled steam chamber. W-W.—A small quantity of water.
H—Heating element. P—Pin that opens switch contact.
D—Diaphragm operated by steam pressure. C-C—Switch contacts.
a, *b*, *c*, *d*—Cooking vessels in contact with wall.

contacts close again. Long-continued tests show that the diaphragm will last without deterioration for "several generations."

The drawbacks to this method of cooking are obviously the long time required for cooking, which is objectionable when a meal is wanted in a hurry, and the fact that the method is not the best for frying or cooking pastry. The use of the hot plates, however, partly overcomes these objections, and there are many undoubted advantages in the system.

The oven is made by the Berkely Electric Cooker Co., of 228, Monadnock Building, San Francisco.

New Insulating and Heat-Resisting Material.

A heat-resisting insulating material, composed chiefly of mineral fibre as a base, which is called "papco," and is impregnated with a binder called "liquid papco," is being placed on the market by the Pressed Asbestos Products Co., 451, West Nineteenth Street, New York. The liquid binder is said to possess high dielectric strength and heat-resisting qualities, and is, therefore, useful for the impregnation of magnet coils, &c. The insulating material is made up in densities varying from a substance which is soft and fibrous like wood, and which will easily hold a screw, to a hard, dense material which will take a high polish. In all densities the manufacturers claim that the material can be easily machined. By varying the composition the substance is made to withstand temperatures up to 2,600° F. The material is also being made in a plastic form to cover old cables in manholes and splicing chambers without disturbing the cables. The material is not brittle, and in many respects has the same properties as wood, excepting that it does not shrink, warp or slip, and is acid and fireproof. When being moulded, it is solidified under heavy hydraulic pressure—giving it great density and a fine texture. According to the manufacturer, the material is well adapted for making handles for aluminium and copper ware, electrical tools and other devices.—*Electrical World.*

The Uni-Lectric Machine.

A new departure in the way of a self-contained electric lighting set has been introduced by Messrs. Walter D. Fair & Co., of 43, Leicester Square, W.C., who kindly afforded us an opportunity of seeing it at work last week. It consists of a dynamo, petrol-engine, and controlling apparatus all built into one co-ordinate design and mounted on a common bedplate, as illustrated in fig. 7, which is a view from the generator end. The distinctive feature of the system is that no battery is used; the engine is kept running during the whole time that light is required, and therefore it is essential to secure reliability, steadiness of running, and

economy in the highest possible degree, together with the utmost simplicity of management. Fig. 8, a ghost view of the apparatus, indicates its general arrangement.

The cast-iron frame consists of an open tank on top, hollow sides, and a hollow base-plate, all of which form connected chambers in which the cooling water circulates. The engine is of the single-acting four-cycle type, with a rotary sleeve valve, and has a bore of 2¼ in. with 3-in. stroke; it runs at a full-load speed of 1,950 R.P.M. The fly-wheel, between the engine and generator, is provided with fan blades drawing air through the generator, and discharging it against the fins of the radiator columns. There is only one main bearing, next to the crank, and the bearing and journal are both of steel, hardened and ground; this is a novel practice, and would be thought objectionable but for the fact that the parts never run in metallic contact, an exceptionally generous supply of oil being continuously forced through the bearing—at the rate of no less than one gallon per minute. The crank-pin and piston-pin are also hardened and ground, and flooded with oil, so that all these working parts practically float on oil, and should last indefinitely. The outboard end of the generator shaft is carried on a ball-bearing. It will be seen, in fig. 8, that the fly-wheel and generator, parts which are least likely to get out of order, are right inside the machine; the little engine is fully exposed at the end, and is readily accessible, together with the governor and the carburetter. The starting gear is of an ingenious type, which releases the moment the engine starts, and cannot possibly injure the user in the event of a back-fire; the brush gear is just behind it, and can easily be got at.

The generator is shunt-wound, and is rated at 500 watts, at 110 volts, but can carry 750 watts, if desired, without heating or sparking. Its voltage is maintained correct by an electric governor, which varies the speed from about 1,500 R.P.M. at light load to 2,000 R.P.M. at 750 watts. This governor consists of a solenoid connected across the terminals of the generator, and acting on a soft-iron core, the weight of

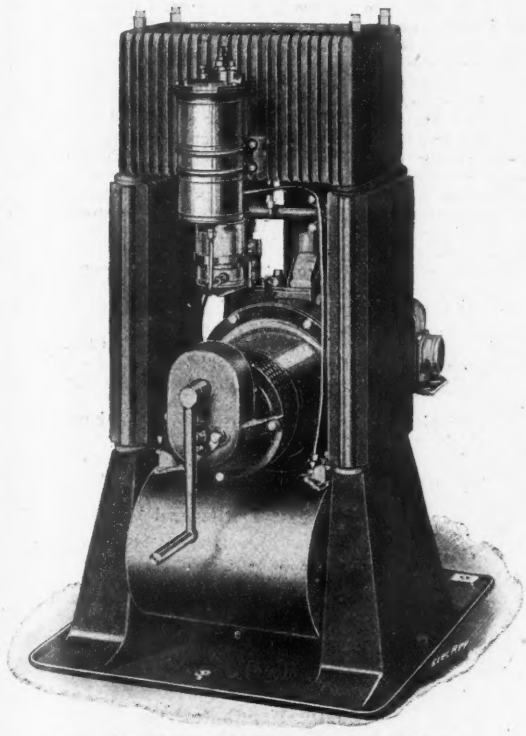


Fig. 7.—End View of Uni-Lectric Machine.

which is borne by a wooden float in mercury. This acts through a rack and pinion on the engine throttle, and is very effective, the pressure variation throughout the range from no load to full load being very small, and hunting being absent. The carburetter was specially designed for the machine; it is of the float feed type, and is provided with a simple set of ball valves to regulate the supply of air to the engine. The petrol tank, as shown in fig. 7, is at the base of the machine, and it is easily filled through a convenient pipe seen over the top of the sparking plug in fig. 8. The fuel is raised from the tank to the float chamber by an automatic device connected with the air intake. So long as there is plenty of fuel in the reservoir, this connection is closed, and the reservoir is open to the atmosphere through a small air vent, but when a float falls below a certain point the vent is closed and the connection to the air intake is opened, causing a partial vacuum in the reservoir. The latter is connected by a pipe with the petrol tank, and the suction thus produced draws the liquid up into the chamber until the float rises and restores the original conditions. The wall of the carburetter float chamber is a glass cylinder, through which the interior can be inspected. A magneto is used for ignition, this, the lubricating pump, and the rotary sleeve valve, all being driven by skew gear. In order to ensure perfect freedom from dirt in the petrol, the whole of the fuel supply is filtered through filter stone.

The torrent of oil through the bearings might give trouble through oil being forced out of the bearings; for this reason a partial vacuum is maintained in the crank case by a connection

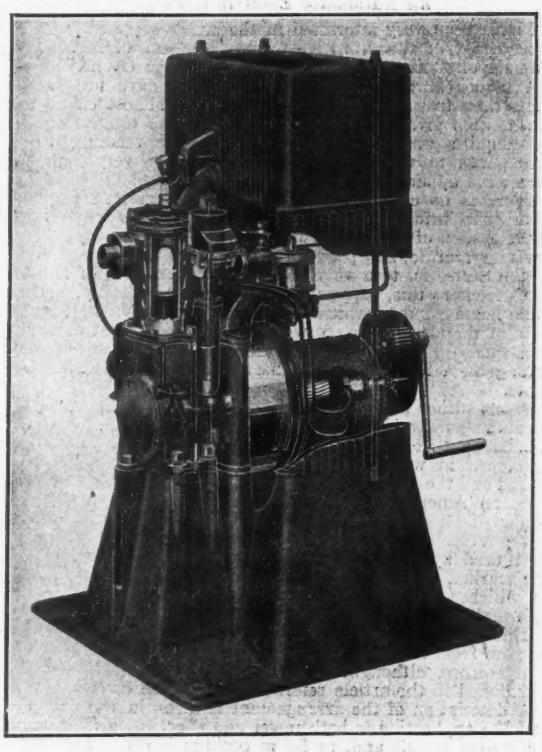


Fig. 8.—Ghost View of Machine.

with the air intake, so that atmospheric pressure prevents the oil from escaping and ensures its return to the oil reservoir in the base-plate.

The attendance required is confined to filling the petrol, oil, and water tanks, switching on the magneto, and turning the starting handle. The machine is guaranteed for five years. It runs with remarkable freedom from vibration, even when not bolted down in any way, and having seen it started and stopped, and run under various conditions of load, we can speak for the simplicity of management, and the steadiness of running which are claimed for it. It should prove a popular means of obtaining electric light—and power up to 1 H.P.—especially as it is highly economical, and of moderate first cost. The consumption of petrol on light load is half a pint per hour. Messrs. Walter D. Fair & Co. have the sole rights controlling the machine in the United Kingdom.

Showroom Window Lighting.

We illustrate herewith a lamp shade such as the Edison and Swan United Electric Light Co., Ltd., Ponder's End, are

Fig. 9.—Ediswan Lamp Shade.

circulating among their customers for use in their showroom windows. We have little doubt that the shades will be very acceptable in these days of lighting restrictions.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Automatic Electric Cooker.

I have been very interested in the article supplied from the proceedings of the Am.I.E.E. from the pen of Mr. P. W. Gumaer on "Economic Operation of Electric Ovens."

As a constant reader of your journal, I have been struck from time to time with what one might almost call a lack of attention given to this particular branch of electric cooking by English manufacturers, the tendency seeming to be throughout to work upon the principle of a very high heat such as is applied in the ordinary range or gas stove.

There is no doubt whatever that the American engineers have gone into the matter very thoroughly as regards the above system of cooking at what is considered a comparatively low temperature, and possibly the fact that the mode of living in the States is, to a very great extent, a system of flat life, lends itself to this, especially as with a small family, and the small home comforts which the ordinary flat provides, it is only natural that the housewife wishes to be out a great deal, and, consequently, this means that there must be some automatic arrangement for cooking, or meals must be taken at restaurants.

I was rather surprised when going through this article to read the paragraph towards the end stating that the author considered that "automatic electric ovens will probably be developed in which the temperature will be accurately controlled and the necessity of constant vigilance will be removed."

As an American, I thought that he would have met with one application of this which is in vogue in the United States, but principally, I believe, in the western portion. I refer to that used by the Berkeley Electric Cooker, known, and on the market, in the States as the "good-housekeeping cooker," *re* which I enclose a small pamphlet giving a good deal of information and facts.

This cooker is absolutely automatic in action and, as can be seen from the description, is fairly well regulated as regards temperature, although, of course, not working to the ideal mentioned in the article referred to, *viz.*, one or two degrees.

A description of the arrangement is given in the pamphlet, and the application is both novel and effective, giving exceedingly even results and, as far as cooking is concerned, practically the same results as those obtained under experiment, with the exception that the temperature is hardly high enough for bread and biscuit, such as is described by Mr. Gumaer.

As far as cost is concerned, this is without doubt one of the greatest advantages of this style of cooking.

I myself have used one of these for about 18 months with excellent results, having in addition a gas stove of a well-known make recognised as one of the most efficient type.

The respective costs here in this city for gas and electricity are 5s. 3d. per 1,000 ft. for gas and 2½d. per unit for electric power and cooking.

With identical meals cooked in each, the respective costs, as a result of several tests, proved that the electric cooker was under half that of gas in every case; and with the electric meter and gas meter at convenient positions to the house it is not a very difficult matter to follow up the exact costs for testing purposes, especially as an integrating watt-hour meter registering in Board of Trade units and decimals of same, and a gas meter reading in cubic feet, are used for comparison purposes.

An average meal consisting of a joint, two kinds of vegetables, and one or two varieties of sweets, can be cooked with a consumption of under one unit, taking from three to four hours, whereas with gas it is found, on an average, 80 to 100 ft. are consumed for the same amount of cooking, whilst, in addition to this, the shrinkage in the meat is a big consideration, this being even with the most careful regulation of heat, which in conducting experiments of this kind had been carefully looked to.

The firm by whom I am employed in the capacity of engineer have taken the agency for this particular cooker, and have interested themselves very largely in the question of experimental and demonstration work on it, and the results obtained have more than carried out the opinions formed from the demonstrations given previous to going into the matter thoroughly.

When it is remembered that this is practically the first cooker of this particular type on the market (to the best of my knowledge), it is to be admitted that the science of automatic cooking, if one might almost call it that, has without doubt a very good start.

The convenience of being able to fix up a meal first thing in the morning, set the time switch and arrive home at any time between six and seven in the evening, knowing that the dinner is absolutely cooked to a turn, takes an enormous amount of responsibility and fatiguing worry off a housewife's shoulders, and when, in addition to this, it is remembered that the waste is practically nil, the amount of attention reduced to a minimum, and the saving in cost a very big item as well, it is not surprising that this has been christened in the neighbouring city of Melbourne by several interested persons "The Fairy Tale Cooker."

As regards temperature, it is, of course, impossible to raise the temperature of the oven itself to more than about 250 deg. Fahr.; but with this temperature it is somewhat of a surprise to a great number of people to find the immense variety of foods which can be cooked perfectly satisfactorily, although possibly somewhat slower than in the ordinary oven.

The average householder is a great believer in having roast meats thoroughly browned on the outside; but I am inclined to think that a great deal of this is purely habit, and once one is accustomed to not having this, the flavour which is preserved in the meat, I am inclined to think, quite makes up for this absence. At the same time, it is a very easy matter to sear the outside of a joint over a live flame or a flat electric heater such as Mr. Gumaer mentions.

As regards the insulation arrangement of the Berkeley cooker, it is more of the type described in No. 2 oven in Mr. Gumaer's article, the outside of the cooker being blued steel sheet, the top of the same where any radiation can take place being of nickelled iron, and the lid itself insulated with slag wool about 2 in. deep. After four or five hours' cooking the temperature of the steel covering is little, if any, higher than the surrounding air, and, although I have never had the opportunity to take any actual tests, I should say that the percentage of heat lost is very small indeed, and the efficiency extremely high.

The current consumption by the heater of this cooker when operating is about 500 to 550 watts; but on an average it is found that when actually cooking, current is not being taken by the heater for more than about a quarter to a third of the actual time taken for cooking, this being indicated by a small pilot lamp mounted on the side of the cooker.

I am writing more particularly with the object of obtaining information as to whether this type of cooker and any arrangement such as described is in vogue in England at present. I have seen no description nor any advertisement illustrating anything like this in the English papers, and from what I can see, an apparatus of this description, developed upon lines such as these people are working on, should offer an excellent field both for experimenting and practical utility. This particular firm evidently has been the first to adopt this principle in a commercial manner and place it upon the market in a form which can be applied by the average householder.

We have recently received a letter from Norway showing that this cooker evidently has a fairly good hold of the public there, judging by the information given. As most of the electricity supply undertakings develop their current by water power, the householder is in a very much more favourable position to purchase current than under the usual system. The companies dispose of the current, I understand, at a flat-rate of so many watts day and night at a fixed rate, regardless of what the application is.

This amount being limited to the minimum required, tending as it does to eliminate peaks, current can naturally be supplied at very cheap rates, and if supplied to an economical cooker, such as the one described, one can imagine the results obtained and the low costs. This latter part is interesting, showing, as it does, the application in a foreign country and the excellent arrangement put forward for the current consumer.

In conclusion, if any of your correspondents have information which applies to this particular subject, we would be glad to hear direct from them, if possible, or through your good self, as the servant problem is quite as acute in Australia, if not more so, than in England or America, and any labour-saving ideas are always welcomed by the Australian public.

F. W. Fisher.

c/o Newton McLaren, Ltd., Leigh Street,
Adelaide, *August 10th*, 1915.

[We refer to this matter in our leading columns to-day, and the oven is described in our "New Devices" column.—EDS. ELEC. REV.]

Pocket Dry Batteries.

I noticed in a recent issue a letter signed "Dry Battery Manufacturer," wherein he complained that he was unable to obtain more than 1.4 volt per cell, and invited the experience of other manufacturers on the subject. Although not a manufacturer myself, I have for some time been making small dry batteries (for pocket lamps) for my own use, and have been able to regulate the voltage of the cells between 1.4 and 1.8 volts to suit my own convenience.

Howard Berry.

London, N., *September 19th*, 1915.

Church Lighting.

We wish to make a few remarks regarding church lighting with reference to the letter by "Lux." We have had in hand, and completed, the electric lighting of an old church which dates back to the year 1240 A.D. This was illuminated by paraffin lamps, and we can assure him we had no small difficulty to get the best effects with electric light; but by converting the old paraffin chandelier in a most suitable manner, and using a shade which nearly obscured the bulb, we obtained the result of a brilliant, yet beautiful, soft light, which gave the inside of the church a pleasing appearance when illumi-

nated. This is in a village of 300 inhabitants, for whom we installed a water turbine plant two years ago with every success. We should be pleased to place our engineer at his disposal, and supply him with any information that he may require (gratis).

J. H. Oxley.

Skipton, *September 20th*, 1915.

[Several other correspondents have offered assistance in this matter, and have been put in touch with "Lux."—Eds. Elec. Rev.]

EFFICIENCY CONSIDERATIONS IN HEATING WATER ELECTRICALLY.

The increasing popularity of "cheap-unit" tariffs, *i.e.*, tariffs —Point Five tariffs among them—which charge ½d. or less per unit of electrical energy consumed (supplementing this charge, if necessary, by a minimum fixed charge), should arouse fresh interest among central station engineers and manufacturers in the possibility of heating water electrically for domestic use. The difficulty in the problem is entirely economic. With current at lighting rates, say 3d. or 4d. per unit, heating water electrically by the 10, 20 or 50 gallons is out of the question. With current at 1d. per unit, the electric system enters the field of practical politics, but full allowance has to be made for the (very real) monetary value of the convenience and cleanliness of electric, as compared with other heating systems. Using current at ½d. a unit, there are many cases in which electric heating for water in bulk will show distinct economy over other systems. Already domestic supply at ½d. per unit in industrial centres is being seriously discussed, and with energy at this price there is not the least doubt that electric heating of water should become general. Naturally, the charge of ½d. per unit would need to be supplemented by a fixed charge, but this would be based on the whole installation (lighting, heating and cooking), and a cheap price per unit is the necessary and sufficient condition for the healthy development of all branches of electric heating and cooking.

Though it is not sufficient simply to take account of the thermal equivalent of 1 kw.-hr. of electrical energy, 1 lb. of coal and 1 cb. ft. of gas, and the market price of each, the following estimate serves to indicate the approximate economic position of electrical water heating, and shows that this is by no means so unfavourable as frequently supposed. At 100 per cent. conversion efficiency, we may take 1 kw.-hr. of electrical energy to be equivalent to 3,414 b.th.u., 1 lb. coal to 13,000 b.th.u., and 1 cb. ft. of town gas to 640 b.th.u. With energy at ½d. a unit, coal at 25s. per ton, and gas at 2s. 6d. per 1,000 cb. ft., the cost of 1,000 b.th.u. (still at 100 per cent. conversion efficiency) is 0.146d. for electricity, 0.0103d. for coal, and 0.047d. for gas. Using an electrothermal storage apparatus built on the lines indicated below, 90-95 per cent. of the theoretical heat equivalent of the energy expended can be obtained in the hot water drawn off. The ordinary domestic hot-water system operated in conjunction with the kitchen range can hardly represent higher than 10 per cent. thermal efficiency, and there must be very few coal-fired domestic hot-water systems which attain 30 per cent. efficiency. As for gas-fired hot-water systems, 50 per cent. thermal efficiency is a liberal allowance. Allowing 90, 30 and 50 per cent. efficiency for electric, coal, and gas systems, the costs per 1,000 b.th.u. on the above basis become 0.16d., 0.034d., and 0.09d. respectively. This is with energy at ½d.

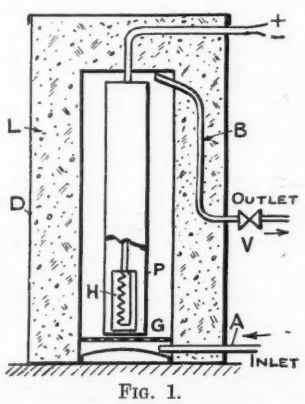


Fig. 1.

per unit, and allowing nothing for the very important advantage of being able to obtain, from an electrothermal storage, hot water at any time of day or night without any delay, labour or mess.

It has been claimed—and the claim appears well justified—that electric heating of domestic water can compete with other systems if the price of electrical energy is ½d. or less (using thermal storage apparatus of 90-95 per cent. efficiency), 0.4d. or less (with storage of 80 per cent. efficiency), and 0.3d. or less (with storage of 65 per cent. efficiency). As prices per unit from 0.5 to 0.25d. are either available or feasible in many industrial centres, and efficiencies of 90 per cent. or over down to 65 per cent. or 70 per cent. are attainable in large and small electrothermal storages (say, 50 to 5 gallons capacity) respectively, the problem of building suitable apparatus deserves the immediate attention of manufacturers, that of central-station engineers being directed with equal vigour to getting the apparatus extensively installed.

It is unnecessary to dilate upon the advantages accruing to central stations from this load. For best results from every standpoint, the apparatus should be in circuit continuously and operate on the accumulator principle, always supplying water at maximum temperature and, in amount, proportional at every moment to the duration of the "charge." Since the losses from a properly designed and constructed storage are very small, it is quite feasible to "charge" only during night hours if this be preferable from the station standpoint.

Conduction and radiation losses are reduced by lowering the maximum temperature to which water is heated, but the thermal capacity of the storage is simultaneously reduced in much greater proportion, so that it pays to heat the water to, say, 90 deg. C. (any higher temperature involving con-

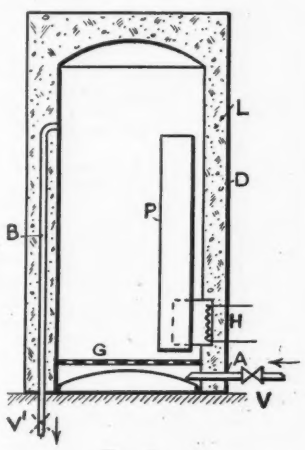


Fig. 2.

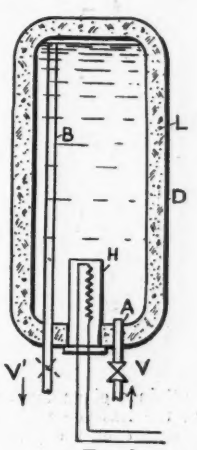


Fig. 3.

siderable loss by steaming). Thorough lagging is, naturally, essential, and it is important to reduce to a minimum metallic connections between the water container and outer casing, and also to prevent appreciable heat loss through the water inlet and outlet. The Rittershaussen thermal storage embodies a number of desirable features. As shown by fig. 1, an "immersion" heater H in circulating pipe P is employed. The water control valve V is in the hot-water pipe B, and the latter, which, of course, starts from the upper surface of the water, runs vertically downwards through the lagging material L for some distance before proceeding out through the casing D. The cold-water inlet pipe A terminates below a diffusing plate G.

The important distinctive features of this apparatus are the *immersion* heater and the *closed* hot-water delivery pipe. Though not completely so, the side- and bottom-heaters shown in figs. 2 and 3 may be termed *external* heaters, and, as explained below, these are much less advantageous. In both figs. 2 and 3 the water control valve is shown in the cold-water inlet, the hot-water pipe being *open*. It is possible, and preferable, to place this valve at V^1 in the hot-water outlet, thus making the heater of the closed type.

The disadvantage of the open-type storage, *i.e.*, one with the hot-water delivery in free communication with the atmosphere, is that continuous loss of heat occurs by evaporation, and expansion of the water as it is heated expels some of the hottest water in the cylinder. Since water expands about 3½ per cent. between 10 deg. and 90 deg. C., there is necessarily 3½ per cent. higher loss in open storages than in closed storages, where expansion of the heated water simply drives back a certain amount of *cold* water through the inlet pipe.

Immersion heaters necessarily give up the whole of their heat to the surrounding water, and the only effect of scale deposits in the water tank is to increase slightly the maximum temperature of the water. On the other hand, side- or bottom-mounted "external" heaters are necessarily subject to a certain heat loss directly through the lagging material; they raise part of the water tank above the temperature of the surrounding water, set up disturbing water currents, and are decreased in efficiency as scale collects on the heating chamber. In the latter respects bottom heaters (fig. 3) are particularly objectionable. The whole mass of water is set in circulation, so that the temperature throughout is more or less uniform instead of there being a variable volume of fully heated water. Also, solid matter precipitated from the hot water is baked on the heater casing instead of remaining clear of the heater

and in the form of a loose sludge, as is the case where there is a stationary bottom stratum of cold water. If the whole of the water be kept in circulation, the hot water delivered is necessarily turbid.

In figs. 1 and 2 the cold-water inlet terminates in a practically stationary layer of cold water beneath the diffusion plate G, and there is, therefore, no appreciable conduction loss through this pipe. Advantage is taken of the very slow transmission of heat downwards through a water column to reduce the otherwise serious loss of heat through the hot-water delivery pipe, by taking the latter vertically downwards through the lagging of the storage tank.

The theoretical "charging" curve (mean temperature against time) of an electrothermal storage apparatus is a straight line and up to 50 deg. C. closed- and open-type storages with immersion or external heaters all follow the theoretical curve very closely. At higher temperatures the losses become more important, and the charging curve bends downwards, longer than the theoretical time being required

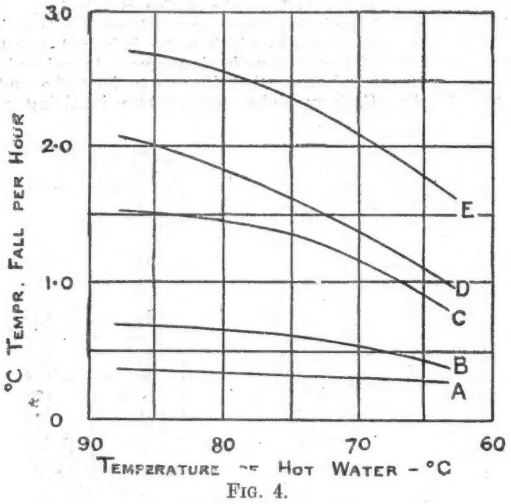


Fig. 4.

to attain a given temperature. The slower the "charging," *i.e.*, the less the power expenditure per gallon, the greater the total energy expenditure required per gallon of hot water withdrawn.

A 45-gallon storage tank heating water from 10 deg. to 90 deg. C. (50 deg. to 194 deg. F.) represents 64,800 B.Th.U. useful storage when fully charged, corresponding to, roughly, 20 kw.-hr. A power expenditure of 45 watts per gallon (2 kw. total) necessitates 10 hours for complete charging. If carried out during night hours only, this provides 45 gallons of nearly boiling water which can be used at nearly maximum temperature during the following day. The curves plotted in fig. 4 are based on test data published recently in the *Elektrotechnische Zeitschrift*, and show how slow is the temperature fall in a large vessel of the type illustrated in fig. 1: what advantage there is in using a large storage (*e.g.*, a 45-gallon storage in preference to a 22-gallon storage, *cf.* curves A, B, fig. 4); and how much more favourable, from the efficiency standpoint, a "closed" storage with immersion heater is than an open storage with side- or bottom-heating. Curves C, D refer to a 5½-gallon storage of the type illustrated in fig. 2 with closed and open hot-water delivery respectively; and curve E refers to a storage of the "Therma" type illustrated in fig. 3.

If charging every night be practised, the most unfavourable case conceivable is that the whole of the water in the storage tank be raised to 90 deg. C. and no water be removed before charging be recommenced the next night. From curve A, fig. 4, it appears that the temperature of a 45-gallon storage of the type illustrated in fig. 1 would then remain between 90 deg. and 80 deg. C., and, assuming an average temperature drop of 0.37 deg. C. per hour, the loss in 24 hours would be

$$24 \times 0.37 \times 450 \times 9/5 = 7200 \text{ B.Th.U.}$$

i.e., 2.1 kw.-hr., or about 10 per cent. of the useful storage. Under average circumstances, the loss could hardly exceed 5 per cent., so that 90-95 per cent. efficiency (on a 24-hour basis) can fairly be attributed to "closed" electrothermal storages with immersion heaters. Due to the more rapid cooling shown by curves C and E, fig. 4, the corresponding efficiencies for the closed storage with side heater and the open storage with bottom heater, to which these refer, are respectively about 82 per cent. and 66 per cent.

Enough has been said to demonstrate the commercial practicability of electric water heating for all domestic purposes, and to impress upon manufacturers and central-station engineers the importance of concentrating attention upon those types of apparatus which yield maximum efficiency. The results attainable are practically 100 per cent. charging efficiency and 90-95 per cent. storage efficiency, and there is no reason why less satisfactory results should be accepted.

WAR ITEMS.

The War and American Electrical Exports.—The June exports of electrical goods manufactured in the United States again show an increase over the corresponding month in 1914. The increase amounted to roughly 600,000 dol., or about 30 per cent. of the total exports in June, 1915. The most conspicuous increases were in batteries, of which the value was practically doubled; in insulated wire and cables, of which approximately 200,000 dol. more was exported in June, 1915, than in June, 1914, and in metal-filament lamps, the exports of which were increased five times. The total electrical exports for the year ended June 30th, 1915, showed a decrease in comparison with the previous year of slightly

EXPORTS OF ELECTRICAL GOODS.

	June.		Twelve months ended June 30.	
	1915. Dols.	1914. Dols.	1915. Dols.	1914. Dols.
Batteries	113,950	58,521	967,146	685,640
Dynamos or generators	191,464	199,955	2,013,130	2,634,365
Fans	48,106	22,717	258,309	432,656
Insulated wire and cables	253,247	74,294	1,911,850	1,992,304
Interior wiring supplies, etc., including fixtures	70,915	51,354	753,351	721,069
Arc lamps	1,826	3,952	30,984	76,766
Carbon-filament lamps	11,432	3,094	101,923	172,004
Metal-filament lamps	78,536	15,719	473,149	219,439
Meters and other measuring instruments	41,214	—	440,916	—
Motors	283,923	231,003	2,817,743	4,541,541
Static transformers	70,543	75,392	624,483	1,455,343
Telegraph instruments (including wireless apparatus)	1,522	26,962	77,271	196,598
Telephones	44,342	69,717	1,149,361	1,552,951
All other	836,061	617,757	8,152,141	10,440,114
Total	2,047,681	1,450,437	19,771,757	25,060,844

over 5,000,000 dol., or approximately 20 per cent. The principal decrease was shown in the motor trade, which fell off by almost 2,000,000 dol. Batteries, interior-wiring supplies and metal-filament lamps alone showed increases, the last-named item having more than doubled its exports during the twelve months.—"Electrical World."

The American "Electrical Review and Western Electrician" gives the following table of the electrical export totals for the fiscal years since 1908-1909, when the last electrical export depression reached its lowest point:—

Fiscal Year.	Electrical Exports.
1908-1909	$12,524,391
1909-1910	14,742,395
1910-1911	18,727,455
1911-1912	20,169,362
1912-1913	26,772,816
1913-1914	25,060,844
1914-1915	19,771,757

This contemporary in an editorial bearing on the matter says that an accurate measure of the war's influence on American foreign trade is obtainable from a study of the Government report on foreign commerce for the fiscal year ended June 30th last, which includes the first eleven months, or practically the first year, of the war. "The most striking fact brought out by this report is that our total exports of domestic and foreign merchandise reached the highest value ever attained in any preceding fiscal year, amounting to 2,768,589,340 dol., or over 12 per cent. above the record established in 1912-1913. At the same time the total imports amounted to 1,674,169,740 dol., or over 11 per cent. less than the record total of the preceding fiscal year. While the electrical exports show a decrease in total value as compared with the two preceding years, the reasons for this are easily understood. The monthly totals in the early months of 1914 reflected an almost world-wide depression in foreign trade which culminated in August with the breaking out of the war and made the electrical total of that month the lowest for several years. Since that time there has been a gradual picking up in electrical shipments, April and June each showing totals of over 2,000,000 dol., and the June total being an increase of more than 40 per cent. over that of the preceding year. This improvement is due chiefly to shipments of electrical war supplies, and partly to the fact that supplies of electrical materials are becoming exhausted in countries that formerly imported them chiefly from the belligerents. Although the total value of the electrical exports reported for 1914-1915 was about 21 per cent. below that of 1913-1914, in the case of some individual classes there was an increase. This was noticeable with metal-filament lamps, which increased over 115 per cent.; batteries also increased over 41 per cent. The comparative monthly figures, of course, show fluctuations in both directions of all the electrical classes, but it is noteworthy that in the case of insulated wires and cables there has been a decided increase each month since last March over the corresponding period of a year ago. This total increase for the last four months of the fiscal year was about three-fourths of a million dollars or 185 per cent. A large part of these increases are due to exceptionally heavy shipments to the entente allies. How long these will continue is problematical, depending chiefly on the continuance of the war. Electrical shipments, like those of so many other classes of merchandise, are still considerably below normal to most of the neutral countries. However, hopes of future improvements in shipments to these countries are natural, because it is reasonable to expect that the agitation for the extension of our foreign trade

which is being taken up co-operatively by our governmental and commercial agencies is to bear fruit in a steadily increasing measure."

German Capital in Russian Electrical Concerns.—A book, by V. S. Zio, has just appeared in Russia dealing with the influence of German capital in Russian industry, which has found expression mostly in the form of limited companies. During the past ten years, it appears, German capital in the Russian electrical industries increased by 123,000,000 roubles (£13,000,000), and it was employed in the richest districts of the country, the favourite centres having been Lodz, Petrograd, and Moscow; and in the end, German companies served the whole Polish area, and the trading and industrial centres of Petrograd, Moscow, and South Russia. They managed to figure in the Russian electrical industries even under the French flag, as in the case of the French Electricity Co. of Warsaw, the shares in which are mostly held by Germans, who, in fact, controlled 22 electrical share companies, i.e., practically the whole electrical industry of the country. The "Novoie Vremya" says that in Russia the branches of German electrical houses executed most of the government and official municipal work. Contracts with the Marine and War Departments were particularly affected by the Germans. They furnished convenient occasions for increasing capital. All the largest electrical concerns operating in Russia were simply branches of German houses. Finland, too, was controlled by them. The Germans readily negotiated Finnish town loans: but on condition that public utility (town) work should be done by Germans. Thus the money lent returned to Germany with handsome profits added.

Trade Union Rules to be Suspended.—The executives of Trade Unions, whose members are engaged in the production of war munitions, at their conference last week passed resolutions pledging themselves to the following:—

1. To secure the suspension of all restrictive rules, practices, and customs, such as the limitation of overtime and the prohibition of piecework on war work in Government arsenals and controlled establishments subject to the statutory safeguards of the Munitions of War Act.

2. To render all possible assistance in the carrying out of a systematic investigation, not only in Government arsenals and controlled establishments, but in all other factories, with a view to determining the least possible amount of skilled labour necessary to enable the machinery to be employed for the full 24 hours in each day.

3. To assist in the reorganisation of the skilled labour employed in Government arsenals and controlled establishments in order that semi-skilled and unskilled male and female labour may be employed on a much more extensive scale subject to the conditions of Schedule 11 of the Munitions of War Act.

4. To give all possible assistance in securing the transfer of suitable men enrolled under the Munition Volunteer scheme to any district where their services may be required, subject to the observance of the conditions applying to the Volunteer Munition scheme, and to assist in the further enrolment of volunteers for this purpose.

The Conference recommended that in order to give effect to the above scheme local conferences of branch and district officials and shop stewards be held in various munition centres, at which the Minister of Munitions or other representatives of his Department shall be present.

A New Advance in German Prices.—A month ago the Sales Bureau of the united makers of insulated conductors announced an increase of 20 per cent. in the prices of rubber-insulated zinc conductors as a result of the increased cost of raw materials and the consequential rise in the cost of production. Now the leading machinery firms have issued a circular intimating for the same reasons an augmentation in sale prices by 10 per cent. from the 20 per cent. advance already in operation, as compared with the pre-war period, to 30 per cent. The new prices apply to the materials used in the construction of generators and motors, including electrically-driven ventilators, pumps, boring machines, etc., starting apparatus, regulating resistances, controllers, oil switches and other switches and railway material. The list prices for generators and motors of over 100 kw. have been abolished, as also have those for transformers of any size. The additions will be expressly stated in offers and invoices, and all offers which have hitherto not led to orders are to be considered as withdrawn. The circular is signed by the firms of the A.E.G., the Bergmann Co., Brown, Boveri & Co., C. & E. Fein, Maffei-Schwartzkopff, Esslingen Engineering Works, Saxony Light & Power, Siemens-Schuckert, and Ch. Weuste & Overbeck.

Restricted Lighting.—The Bradford Chamber of Trade, on Monday last, appointed a special committee to act throughout the winter in taking all possible steps to reasonably keep down the lighting of shops. Though in nearly all surrounding areas rigid lighting restriction orders are in operation, the Bradford order was removed a considerable time ago through the efforts of the Chamber, but a good many shopkeepers have gradually increased the abuse of the privilege, and the Chamber has warned them of the probability of a renewal of the order, with greater severity than before, for the coming winter, if better judgment of lighting is not voluntarily exercised.

Praise for the Signal Service.—In his last published dispatch from the Dardanelles, Sir Ian Hamilton pays the following tribute to the Signal Service:—"In addition to its normal duties the Signal Service, under the direction of Lieut.-Col. M. G. E. Bowman-Manifold, Director of Army Signals, has provided the connecting link between the Royal Navy and the Army in their combined operations, and has rapidly readjusted itself to amphibious methods. All demands made on it by sudden expansion of the fighting forces or by the movements of General Headquarters have been rapidly and effectively met. The working of the telegraphs, telephones, and repair of lines, often under heavy fire, has been beyond praise. Casualties have been unusually high, but the best traditions of the Corps of Royal Engineers have inspired the whole of their work. As, for instance, the central telegraph office at Cape Helles (a dug-out) was recently struck by a high explosive shell. The officer on duty and twelve other ranks were killed or wounded and the office entirely demolished. But No. 72,003 Corporal G. A. Walker, Royal Engineers, although much shaken, repaired the damage, collected men, and within 39 minutes reopened communication by apologizing for the incident and by saying he required no assistance."

An Enemy Lift!—At Fleetwood, on the 16th inst., Mr. J. H. Shorrocks, manager of the Norbreck Hall Hydro, was summoned for a breach of the lighting regulations. A police officer said he saw flashes coming from the hydro, and when he went on the roof with an employé the flashes were found to come from the door of the place containing the apparatus for working the electric lift. Each time the lift stopped or started there was a flash. The defendant had since done something to remedy the matter. For the defendant, it was stated that sometimes the lift got overheated, and the door had been opened to cool it. Defendant was fined £1.

Electrical Works Destroyed by French Artillery.—The French communiqué of September 17th contained the following sentence:—"Our artillery has succeeded in the destruction of the electric factory of Turckheim."

The Central News correspondent in Northern France refers to the matter thus:—"The French heavy artillery has wrecked the important Siemens-Schuckert electricity works at Turckheim, near Colmar."

War Workers and Fatigue.—The Minister of Munitions of War has appointed a committee to consider and advise on questions of industrial fatigue, hours of labour, and other matters affecting the personal health and physical efficiency of workers in munition factories and workshops. Mr. E. H. Pelham is secretary of the committee.

Lighting Regulations.—On the 16th inst. a Putney jeweller was fined £20 for failing to extinguish his shop lights after being cautioned. The police evidence showed that he had 36 lights of 25 c.p. each, unobscured, throwing a beam of light across the High Street.

BUSINESS NOTES.

Australian Imports.—The Queensland Government has decided that, where practicable, it will import its own requirements from London instead of through agents and contractors.—*Tenders.*

Catalogues and Lists.—Messrs. Ikin & Eads, Ltd., 47 to 57, Marylebone Lane, Oxford Street, London, W.—Sixteen-page illustrated pamphlet containing full particulars, prices and code-words relating to "Quead" electric fires, patterns being shown for heating large and medium-sized rooms, also portable models, boudoir patterns, &c.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, E.—Sixteen-page illustrated catalogue (No. 47), containing particulars and prices of electric lighting accessories including various patterns of lampholders, cut-outs, ceiling roses, tumbler switches, counterweight fittings, wall plugs, watertight switches, wood blocks, distribution and fuseboards, &c.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W.—Publication No. 245 just issued contains illustrated particulars and prices of the firm's magneto blasting machine, and the dynamo low-tension blasting machine, also details of spare parts for "Sterling" exploders.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—An excellently produced publication of 80 pages (No. 1,012) deals with the subject of the heating and ventilating of factories. The matter is one of extreme importance in these times when works are going day and night and workers are working long hours and sometimes at high pressure. The publication discusses the various systems, and then gives fully illustrated descriptive accounts of the "Sirocco" heating and ventilating apparatus. A number of particular installations, for example, that at the Central London Railway repair shops, that at the works of Messrs. J. & E. Hall, Ltd., at Dartford, and that at the B.T.H. Works at Rugby are illustrated and described. Many pages follow containing an impressive list of public and other buildings where the Sirocco system is in use.

Book Notices.—*The Wireless Telegraphist's Pocket-Book of Notes, Formulæ and Calculations.* By J. A. Fleming, F.R.S. London: The Wireless Press. Price 6s. net.—Coming from the hand of a past-master in the subject dealt with, this handy compendium of information bears unimpeachable credentials, and is sure to command a wide circulation. It does not claim to be a treatise on wireless telegraphy; as the author states, it is a *memoria technica* of formulæ, data, and useful tables, for the use of telegraph operators and students. It commences with a chapter on mathematical processes, including the calculus and vector analysis, which is followed by one on units and measurement. After this general introduction, the author proceeds to deal with subjects more particularly associated with radio-telegraphy, chapters on high-frequency resistance phenomena and calculations, and problems involving inductance; the measurement of high-frequency current and voltage; capacity measurement and calculation; and the use of the cymometer for the measurement of frequency, wave-length and decrement. Numerous worked examples are given to facilitate the use of the formulæ and tables in arithmetical calculation. The theory of electric waves and radiation from antennæ is the subject of the next chapter, which includes the practical determination of antenna resistance and radiation, &c., and afterwards transmitting and receiving apparatus and detectors are dealt with. One chapter is devoted to practical information for wireless operators, including the International Morse code, the care of storage cells and wireless apparatus, and a glossary of terms; and the last chapter consists of mathematical tables, which are exceptionally well arranged and comprehensive, tables of resistance and weight of copper and aluminium wire, &c. A careful examination of the volume leads us to the conclusion that it will prove of very great value to all who are technically concerned with the design, construction and operation of radiotelegraphic installations, though a considerable portion of the contents will probably be over the heads of amateurs and ordinary operators, owing to the advanced mathematics employed.

Patent Application.—Application has been made by Wilfred Briggs for the restoration of Patent No. 27,805 of 1908, for "Improvements in or relating to brakes for motor-driven road vehicles."

For Sale.—The Corporation of Southport has for disposal a single-decked, 34-seat, tramcar, particulars of which are given in our advertisement pages to-day.

Italy.—A joint stock concern, under the style of the Unione Telefonica Padovana, has been formed at Padua, with a capital of 100,000 lire, for the manufacture and exploitation of telephone and accessory electric apparatus.

Annual Outing.—The Siemens Brothers Woolwich Works Foremen's Association held their first annual outing on Saturday, September 11th. The party (48 in number) journeyed in motor char-à-bancs, *via* Bromley, Keston and Westerham, to Limpsfield. After a ramble, the company took tea at the King's Arms Hotel, Westerham.

Dissolutions and Liquidations.—Belling & Co., Derby Road, Edmonton, electric heating specialists.—Messrs. H. E. How, C. L. Arnold and C. R. Belling have dissolved partnership. Mr. Belling will continue the business alone at the same address, and he will attend to debts, &c.

British Electric Automatic Machines, Ltd.—This company is winding up voluntarily, with Mr. D. Johnston, of 1, Broad Street Place, E.C. as liquidator.

Trade Announcements.—Mr. Arthur James who, until recently, was outside representative for the Record Electrical Co., Ltd., for Lancashire and Yorkshire, has now joined the board of directors of the company, and has transferred his activities to Scotland to further develop the company's business in that area.

The Fuller Electrical and Manufacturing Co. are on 29th inst. removing to Canada House, Kingsway, London, W.C. New telephone number: "Holborn 1441."

LIGHTING and POWER NOTES.

Accrington.—The electrical work for the new Palace Theatre at Accrington, which opened this week, was executed by Messrs. Simpson Bros., of Hapton.

Argentina.—The English Primitiva Gas Co. and the German Electric Light Co. are suing the municipality of the city of Buenos Ayres for long overdue lighting accounts. That of the gas company is for more than $1,000,000 (paper), and that of the electric company for something less ($880.000 m/n.).

The municipal authorities of Ramos Mejia owe $25,000 to the electric light company. It is possible that some of the lighting will be cut off.

A private company at Las Perdices (Province of Cordoba) has been granted a concession for the exploitation of the electric lighting of the town for a period of 20 years.—*Review of the River Plate.*

Australia.—The Electricity Committee of the Sydney City Council recommended that an agreement be entered into with the municipality of Lidscombe authorising the City Council to supply electricity in that municipality on the same terms as those entered into with the municipality of Ryde.—*Tenders.*

The revenue of the Sydney municipal electric light undertaking for the month of May shows the greatest net profit for any month since the inception of the scheme. The total revenue for the month was £37,118, working expenses £13,055, capital charges £11,315, net profit £12,746; compared with May, 1914, the working expenses for the month are less by £222, and the revenue is greater by £8,639. Of the total revenue £30.525 was received from the city, the remainder coming from the 22 suburbs taking electrical energy from the city undertaking.

The Sydney City Council has considered the allocation of the accumulated surpluses of the electric light undertaking for the years 1913 and 1914 amounting to £115,180. The Electric Lighting Committee recommended that £67,323 be written off the sum appearing as goodwill in the balance-sheet. The total amount shown as having been paid to companies and municipalities for goodwill was originally £140,375; up to the end of the year 1912, £55,872 had been written off, leaving a balance of £84,502. An amendment that the goodwill should be written off by instalments so that some of the profit should be available for the relief of the rates was not approved, the Council being in favour of wiping out the goodwill as soon as possible. Next year there will only be £17,000 required to write off this item completely, and the question of the relief of rates will be a simple matter.—*Sydney Daily Telegraph.*

The Sydney city electrical engineer reports that owing to the delay in ordering the 48 panels for the 5,000-volt switchgear it is not thought that it will be practicable to carry out the obligation the Council has undertaken to the northern suburbs, and it is probable that the Council will find itself compelled to pay the penalty provided for in its contract with North Sydney for late completion, and that it will be necessary to put into use temporary switchgear until the permanent plant arrives.

The Tenterfield (N.S.W.) municipality intends submitting to the ratepayers a proposal to borrow a sum of £6,200 for the installation of an electric lighting scheme for the town.—*Tenders.*

Ayr.—Annual Accounts.—The financial statement of the electricity undertaking shows that notwithstanding the high price of coal and a reduction of £600 in the revenue from public lighting the undertaking has had a satisfactory year. The total number of units sold showed an increase of 54,000, in spite of the decrease of 67,000 units in public lighting. The surplus was £1,248, as compared with £1,450 in 1914.

Basingstoke.—Mains Extension.—The T.C. has decided to extend the mains to the western end of Richmond Road, at an estimated cost of £430, there being an estimated yearly revenue of £83.

Bexhill-on-Sea.—Price Increase.—On account of the extra outlay for coal (£664 for the half-year ended March, 1915), the T.C. has decided to raise the price of electricity by 10 per cent. from the autumn quarter.

Canada.—The Dominion Government has issued an agreement under the Dominion Water Power Regulations for a scheme to develop water power on the Elbow River, near the city of Calgary, in the Province of Alberta. The scheme contemplates the utilisation of a 475-ft. working head, by the construction of a dam, 123 ft. maximum height and 565 ft. long on the crest, to span the river, forming a storage reservoir of 21,000 acre-feet capacity. From the reservoir a pressure tunnel will carry the water direct to the power station and turbine, some 4½ miles below, driving generators of a maximum capacity of 15,000 H.P. The work of construction is to be commenced at once. The agreement provides that at least 2,000 H.P. must be developed and available for use by July 15th, 1919. The taking over of the plant by the Government is also provided for, should the public interest demand such a course in the future.—*Canadian Engineer.*

Continental Notes.—Italy.—A company has lately been formed in the little town of Fenis, with the title La Società de Produzione e di Consumo di Luce Elettrica e di Forzi Motrici, to establish a small electricity generating station in the town on a co-operative basis.

Spain.—A company has lately been formed at Mondonedo (Province of Lugo), with the title La Sociedad Hidroelectrica del Tronceda, to acquire the existing plant which utilises the water-power of the Tronceda Falls near that town. The plant, which already supplies current for lighting and power purposes to a number of small towns in the district, is to be considerably extended.

Clifton.—Colliery Plant Extension.—A new power house is being built at the Clifton Collieries, and will be equipped with a 500-kw. B.T.H. mixed-pressure turbo-generator and a Mirrlees-Watson surface condenser. Current will be generated at 2 500 volts. The switchboard is being supplied by the British Westinghouse Electric and Manufacturing Co., Ltd.

Crayford.—Public Lighting.—It is reported that electricity will be utilised instead of gas for public lighting on the new estates at Barnes Cray and Northumberland Heath.

Fermoy.—E.L. Scheme.—The proposed installation of electric street lighting has been approved by the Council. The scheme will include the erection of overhead mains at the backs of houses.

Great Yarmouth.—Price Increase.—The T.C. has decided to raise the price of electricity for lighting from 5d. to 5½d. per unit.

Hale.—With reference to the request for a supply of current to this parish, the Aldershot Urban Council has decided that, under present conditions, it cannot undertake to supply outside the town. When new plant is installed, the Council will be prepared to receive applications from Hale.

Halifax.—Loan Sanction.—The Corporation has been successful in obtaining the sanction of the L.G.B. to a loan of over £20,000 for the purchase of a new turbo-generator capable of taking the whole of the load, the existing plant being only sufficient for the present demand, so that any breakdown would seriously affect factories employed on Government work.

Ilford.—Plant Extension.—The Council has applied to the L.G.B. for a loan of £858 for the provision of electricity generating plant in association with the refuse destructor.

Price Increase.—The U.D.C. has increased the price of electricity from the quarter ending September 29th by 12½ per cent.

Keighley.—Plant Extension.—As the result of negotiations with the L.G.B. the T.C. has received the Board's consent to the whole of the proposed improvements and extensions to the existing plant at the electricity works (involving an expenditure of some £20,000) being proceeded with. The Council pointed out that it would not be able to meet the demand for electricity unless the extensions were carried out, and the slightest accident to the plant might lead to a stoppage of work in those local factories and workshops which were dependent upon electrical energy for their lighting and power.

Leigh.—Annual Report.—There was a profit of £250 on the electricity undertaking for the past year, as against £1,150 in 1914.

London.—Battersea.—Linking-Up Scheme.—With further reference to the negotiations for linking up the electricity undertakings of Battersea, Fulham and Hammersmith, the Electricity Committee reports that the Hammersmith B.C. has decided not to enter into the proposed agreements until it has obtained sanction for the necessary loan. Under the circumstances, and having regard to the urgency of the matter, an agreement has been entered into between the Battersea and Fulham Borough Councils only. The agreement has been submitted to, and approved by, the B. of T. and the L.C.C. The Committee reports that, in agreement with the Fulham Council, it has accepted the tender of Messrs. W. T. Henley's for carrying out the work of connecting the two undertakings, at a cost of £5,641.

Price Increase.—In view of circumstances due to the war, and the increase in the cost of production, the Committee recommends that a charge of 10 per cent. be added to the accounts for the supply of electrical energy, as from the date of the next readings of the meters, the altered charges not to apply to cases in respect of which there are special agreements.

Shoreditch.—Annual Accounts.—The accounts of the electric supply and refuse destructor departments for the 12 months ended March 31st last show a reduction of income of the electricity department of £3,107, as compared with last year. Notwithstanding the reduced income, the gross profit is less by only £1,371. During the year £4,909 has been contributed from revenue (reserve fund) towards capital expenditure, the total contribution for the two years being £5,768. After meeting loan and interest charges and war allowances, the surplus, £1,509, plus £120 brought forward, is disposed of as follows:—Transferred to reserve fund, £1,400; to change of pressure account, £137; carried forward, £92. The net cost of the destructor is greater this year owing to the difficulty of disposing of the clinker residue and the allowance to men on active service. The electrical energy generated by the destructor amounted to 589,244 units, for which the electricity department paid £1,095, in addition to £300 for stand-by.

Lowestoft.—The T.C. has offered to supply current to the new works of Maconochie Bros. at the usual standard charges, the firm to pay 5 per cent. on the capital outlay required for the supply, and to enter into an agreement for a term of years equal to the term of repayment of any necessary loan allowed by the L.G.B. The prospective capital outlay is £2,500.

The borough accountant reports that there will be a considerable deficiency on the electric lighting undertaking for the current year. In an ordinary year the Council pays to the undertaking for public lighting £2,550. It is now suggested that the Council should pay a sum equal to the sinking fund and interest, namely, £850, and a further £1,500 towards the deficiency.

Lymington.—Street Lighting.—By arrangement with the E.L. and Power Co. the public lighting account for the past quarter (owing to restricted lighting) has been reduced from £72 to £47. None of the lamps were lit during the period named.

Newport (Mon.)—Loan Application.—Several Committees of the T.C. have notified increases in the estimates of expenditure. The largest net increase is that of £760 for street lighting. The ordinary lighting service is being maintained, and provision has to be made to meet the increased cost. The L.G.B. and the Treasury are to be approached with a view to obtaining their approval for the proposed acquisition of a site, and the raising of a loan for a sub-station for the Pillgwenlly area, where the demands for supply are constantly increasing.

Rawtenstall.—The boiler house of the electricity station has now been completed and all the new plant is running. Certain minor additions are to be made.

Sheffield.—Plant Extensions.—The L.G.B. has sanctioned the borrowing of £10,500 for the installation of electric plant. A special sub-committee has been appointed with power to take any steps that may be necessary to expedite the completion of the buildings at Neepsend and to purchase any necessary plant, so as to enable the extension to be completed without avoidable delay. Mains are to be extended, at a cost of about £15,424. Of this sum £13,000 will be spent on a new extra-high-pressure feeder from the Neepsend power house to Brightside Lane. The Electricity Supply Committee has accepted the revised schedule of prices for cables submitted by Messrs. W. T. Glover & Co., Ltd. The Finance Consultation Committee has approved a supplementary estimate of £20,000 for expenditure on mains extensions for the financial year ending March 25th last. The money is part of £75,000 for which a formal sanction of the L.G.B. was granted in September, 1914. At a recent meeting of the City Finance Committee it was reported that owing to heavy demand for power supply for war work it was necessary that additional machinery should be purchased for the electric supply department, at an estimated cost of £100,000, and that the Government had given an assurance that the Corporation would be indemnified against any loss. The Committee approved the proposed expenditure, and of the plant being ordered forthwith.

Southend-on-Sea.—Price Increase.—Arrangements are to be made for reducing the amount of electricity supplied by prepayment meters, so that the charge shall work out at the rate of 6d. per unit. The alteration will come into force on October 24th. The Electric Lighting Committee is unable to agree to the request of the contractors for the supply of coal for an increase of 4d. per ton for cartage, but is prepared to pay, during the period of the war, or during the term of the present contract (whichever may be the shorter) the sum of 2d. per ton over the contract rate. The Committee recommends the Council to authorise the electrical engineer to purchase lathes and drills for use at the works, at a total approximate cost of £388.

Street.—After several months' delay the electric lighting scheme has been completed, and the electric lighting of the streets was commenced on Friday last week.

Surbiton.—The *London Gazette* contains notice of the proposed transfer of electric lighting powers from the U.D.C. to Messrs. Callender's Cable and Construction Co., Ltd.

Swindon.—Price Increase.—The T.C. has increased the price of electricity as under, as from October 1st:—Lighting, 12½ per cent., or ½d. per unit; power, 12½ per cent.; public lighting, 10 per cent.; tramways, 10 per cent.; heating and cooking, ½d. per unit. To meet the demand for power for the new factory of Messrs. Gundry, a new main is to be laid, the estimated cost being £340 underground, and £231 overhead. The B. of T. is to be asked to sanction the latter.

Taunton.—Price Increase.—The Electricity Committee recently reported that it had carefully considered the terms of the agreement with the Tramways Co. for the supply of electricity, and being satisfied that they were favourable to the Corporation, saw no reason for variation. With regard to the charges for energy to other consumers, the Committee recommended that an advance of 15 per cent. be made for lighting and for electricity used for cooking, heating and motive power. The lighting increase includes a 10 per cent. advance recently made. It will produce an additional revenue of over £1,000 and save the undertaking from being worked at a loss. The Council approved the recommendations.

Tynemouth.—The Electricity Committee proposes to reduce the rent of outside lamps by 50 per cent., and a similar reduction is proposed to be made in cases where a charge is imposed for wiring which has been provided by the department. The electrical engineer has reported as to the application for a reduction in price for electricity supplied to kinema theatres, but the Committee has deferred consideration of the matter until the accounts of the past year have been submitted. Some time ago the Council agreed to a request of the Newcastle Electric Supply Co. that the bulk supply should be metered with three-phase meters. The company have since written stating that they wish to replace the existing meters by new ones, at a cost of £131, half of which would be payable by the Corporation. The electrical engineer has been empowered to arrange accordingly.

Whitstable.—Street Lighting.—Restricted lighting has led to differences between the U.D.C. and the E.L. Co. The latter, after taking counsel's opinion on the agreement, asks the Council to pay £2 10s. per lamp, so as to save the cost of arbitration. The Council, on the other hand, puts forward the opinion of Mr. McCardie that under the Defence of the Realm Act the contract is void. The Council has decided to submit to the secretary of the company a letter from Mr. McKenna, upon which Mr. McCardie bases his opinion.

York.—Loan Sanction.—The T.C. has received sanction from the Treasury and L.G.B. for the following works:—Cooling plant, £3,426; electric plant extensions, £15,936; motor omnibuses, £5,530; garage and boosters for omnibuses, £650; tramway extensions, £21,350.

TRAMWAY and RAILWAY NOTES.

Australia.—The Queensland Minister of Railways stated in the Legislative Assembly that 14 railway stations were supplied with electric light by the Tramway Co. The total cost was £2,980, but that price included the cost of energy for the Roma Street workshops, printing office, electric cranes, &c. The Commissioners' Roma Street scheme provided for an up-to-date electric plant which would not only provide the necessary motive power, but light up all the stations within a 10-mile radius of the General Post Office.—*Tenders.*

The New South Wales Government tramway returns for the year ended June 30th give the following figures:—Earnings, £1,986,060 (increase £51,896); working expenses, £1,611,286 (decrease £57,747); passengers, 289,282,845 (decrease 21,309,853); lines open, 219¾ miles (increase 7¾ miles).

Ayr.—Annual Accounts.—Owing to the lessened summer traffic the revenue of the Corporation tramways last year was £1,392 less than in 1914, and the working expenses increased by £300. There was a deficit on the year's working of £351, which has been taken from the reserve fund, which now stands at £4,648.

Continental.—Italy.—The litigation pending between the Società Varesina per Imprese Elettriche and the State Domainal Administration relating to the ownership of the Lake of Ghirla has ended, temporarily at least, against the Società. The Società works the Varese-Ghirla-Luino line by electric power generated by water drawn from the Lake, having acquired its title from a certain reputed owner named Ghisolfi. The Court of Appeal hold that the Società has not made clear its case, pending which it will have to pay the dues demanded by the Demanio. The ownership of the Lake of Ghirla, therefore, still remains unsettled, and the only resort of the Varesina Society is to carry the question before the highest Court at Rome.

The Società Roma-Nord, which works the Roma-Civitacastellana tramway and the Civitacastellana-Viterbo electric railway, has received permission from the Superior Council of Public Works to electrify the former section of its system.

Glasgow.—The receipts of the Corporation tramways for last week were over £23,000, the highest total reached in the history of the undertaking; the number of passengers carried exceeded seven millions. Over 800 women conductors are now employed on the tramcars.

Lowestoft.—The borough accountant reports that the estimated loss on the Corporation tramways for the year ending the 30th inst. is £2,700, and recommends that £1,000 of this be provided for in the borough rate. The total tramway takings amounted to £8,415, as against £10,318 for the corresponding period last year.—*Eastern Daily Press.*

Manchester.—About a dozen additional women conductors have been appointed, and it is expected that the two women conductors now working, who have previously been connected with the office staff, will be able to render useful service in helping to train the new-comers. In Salford about 70 women conductors are now employed.

Rawtenstall.—Female Labour.—The Tramways Committee of the Corporation is inviting applications from women for positions as conductors on the electric cars on the same terms and conditions as men, but for the period of the war only.

Southend-on-Sea.—The electrical engineer reports that steps have been taken to prevent, as far as possible, sparking taking place on the overhead equipment of the tramways. Authority has been given to engage women as conductors if any difficulty is experienced in obtaining suitable men for the positions. In view of the difficulty of collecting fares during the period of restricted lighting, bull's-eye lamps are to be purchased for the use of conductors, at an approximate cost of 2s. 6d. each.

Uruguay.—A project for the establishment of an electric tramway system in the town of Paysandu has been included by the Uruguayan Government in the agenda for the present special Parliamentary period.

TELEGRAPH and TELEPHONE NOTES.

Cocos Island.—The local superintendent of the Eastern Extension Co. (Mr. A. B. Skottowe) reports that the wireless station at Cocos Island, which was destroyed by the German cruiser *Emden*, is now again in full working order.

Long-Distance Telephony.—One of the special features of the Electrical Exhibition which is to be held in New York next month will be a series of demonstrations of the working of the new trans-continental telephone line between New York and San Francisco. A demonstration hall, similar to that at the Panama-Pacific Exhibition in the latter city, is to be erected in Grand Central Palace, New York, and all the 250 seats are to be provided with receivers, so that the two audiences—one in New York and one in San Francisco—may listen to greetings from each other. In considering the practicability of carrying on the demonstrations, it was discovered that the difference in time between the two places would be no hindrance to the scheme. Thus, simultaneously with the first daily demonstration in San Francisco, at 11 o'clock in the morning, the early afternoon audience will have assembled in New York, demonstrations then being held every hour afterwards up to 5.30 p.m. at the western terminus of the line, and up to 8.30 p.m. at the eastern. The commercial toll rate for three minutes' use of the trans-continental line is $22 (£4 11s. 8d.), so that the value represented by the use of the line for the ten days of the Exhibition is approximately £2,640. Both in New York and in San Francisco a lecturer will explain by the aid of moving pictures the construction and the electrical and mechanical features of the line.

Telegraph and Telephone Tariffs.—The new Budget contains important changes in the charges for telegraph and telephone services. Private telegrams will bear an addition of 3d. per telegram; the inland Press telegram tariff is raised from 1s. to 2s. 6d. per 100 words (night) or 75 words (day) for first address, and the copying fee is raised from 2d. to 8d. per 100 (or 75) words for every address after the first.

The "unlimited" telephone rate is raised from £17 to £20 per annum in London, and from £10 to £12 in the provinces (new subscribers cannot obtain the flat rate at all). Two-party lines will pay £7 10s., and four-party lines £5 per annum. The trunk service fees are raised by 33⅓ per cent. all round (except 1d. and 2d. fees, which become 2d. and 3d. respectively). Call office fees are increased from 2d. to 3d. in London, and from 1d. to 2d. in the Provinces.

The new tariffs will probably come into force on November 1st, 1915.

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—October 25th. Six electrically-operated wharf capstans, for the Sydney Harbour Trust. Forms of tender from the Engineer-in-Chief, Harbour Trust Offices, Circular Quay.*

October 25th. For the Commonwealth Department of Defence (Navy Office). Supply, delivery and erection of power-station plant and equipment for the Commonwealth Naval Dockyard, Sydney.*

January 12th. N.S.W. Railway and Tramways Department. Two water-tube boilers, each 8,000 sq. ft. heating surface complete with economisers, superheaters and chimney stack, for the Zara Street power house, Newcastle. Particulars, Electrical Engineer's Office, 61, Hunter Street, Sydney.—Specification (No. 468), 20s. each.—*Tenders.*

City Council. An Australian newspaper for August 2nd stated that tenders would shortly be invited for the following:—Linemen's hand carts; 10,000-volt outdoor type line switches; contact and suspension gears; transformer kiosks; 33,000-volt outdoor transformers and switchgear; time switches.

Victoria.—December 14th. P.M.G. For delivery in all States, 18,670 common-battery wall pattern telephones, manufactured in Australia. Sched. No. 1,264.

Victorian Railways.—January 5th, 1916. Installation of automatic sprinklers and thermostats at Jolimont car-shed. Chief Storekeeper, Railway Offices, Spencer Street, Melbourne.

Dundee.—September 27th. Heating and ventilating the City Hall Buildings, Dundee. Mr. Jas. Thomson, City Architect.

Exeter.—September 27th. Corporation. Three, six or twelve months' supply of steam (washed bean or pea) coal, for the Electricity Works. Mr. H. Lloyd Parry, Town Clerk.

Keighley.—September 27th. About 12,000 tons of small slack for Electricity Department. H. Webber, Borough Electrical Engineer and Tramways Manager.

Liverpool.—September 25th. Electrical sundries for three months for the Toxteth Park B. of G. Mr. H. A. James, Clerk, 15, High Park Street.

London.—H.M. Office of Works.—October 1st. Repair of incandescent electric lamps. See "Official Notices" September 17th.

L.C.C.—October 5th. Heating and ventilating installation at Charlton Tram Depôt. Specification, &c. (£1 1s.), from Superintendent Architect's Department, Aldine House, Bedford St., W.C.

Manchester.—September 30th. The Lancashire and Yorkshire Railway Co. 12 months' supply of various stores. Mr. Waring, Stores Department, Osborne Street, Manchester.

September 27th. Corporation Tramways. Two light motor-driven parcel delivery vans. Specifications, &c., from Mr. J. M. McElroy, General Manager.

New Zealand.—Dunedin.—November 3rd. City Council. Insulated and bare copper wire for a period of two years.*

November 3rd. Dunedin City Council; one 3,000-volt regulator.*

Salford.—October 4th. 20,000 pairs of carbons for the electricity department. See "Official Notices" to-day.

Shanghai.—September 29th. E.H.T. switchgear, static transformers, and underground cables for 22,000 v., for the Municipal Council. See "Official Notices" August 27th.

South Africa.—JOHANNESBURG.—October 9th. Municipal Council. Water-purifying plant with a capacity of 75,000 gallons per 24 hours, for the generating station.*

Spain.—The municipal authorities of Villarrasa (Province of Huelva) have just invited tenders for the concession for the electric lighting of the town during a period of ten years.

Warrington.—September 28th. Twelve months' supply of earthenware conduit, for the Electricity Department. See "Official Notices" September 17th.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Australia.—The following contracts have been placed :—

VICTORIAN RAILWAY DEPARTMENT.

Low-tension cables, bare: Item 1, 19/14 S.W.G., 1s. 2¾d. per lb.; item 2, 19/12, 1s. 2¾d. per lb.; item 3, rubber-insulated 7/16, £43 15s. per mile; item 4, do., 19/18, £73 2s. per mile; item 5, do., 19/16, £122 per mile; item 6, do., 19/14, £181 per mile; item 7, do., 37/18, £424 per mile.—W. T. Henley's Telegraph Works Co., Ltd.

Low-tension cables, bare: Item 1, 19/12 S.W.G., 1s. 2¾d. per lb.; item 2, 37/14, 1s. 2¾d. per lb.; item 3, 37/12, 1s. 2¾d. per lb.—British Insulated and Helsby Cables, Ltd.

Re-arrangement and relaying cables near Montague Railway Station in connection with the erection of new shipping shed, £700.—Melbourne Electric Supply Co., Ltd.—*Australian Mining Standard.*

VICTORIAN STATE COAL MINE.

Resistance wire, at rates.—W. T. Henley's Telegraph Works Co., Ltd.

The Electric Lighting Committee of the Sydney Municipal Council recommends that the tender of Standard Waygood Hercules, Ltd., for 33,000-volt switchgear be accepted for all items but lightning arresters for the equipment of new sub-stations.

5,000-volt transformer panels, £97 each; 33,000-volt do., £289 each; 33,000-volt incoming feeder panels, £255 each; 33,000 volt outgoing overhead feeder panels, £302 each; 415-volt transformer panels, £221 each; 415-volt summation panels, £67 each.

Also that the following additional lamps and compensators required for public lighting be obtained under existing contracts :—

From the British General Electric Co.—10,000 50-C.P. vacuum lamps, £713; 2,500 100-C.P. do., £312.

From the Australian General Electric Co.—1,000 750-watt nitro lamps, 240 v., £1,487; 1,000 500-watt do., £1,224; 500 300-watt do., £525.

1,000 750-watt nitro lamps, 45 v., £962; 1,000 500-watt do., £662.

350 lanterns, £1,137; 100 spare reflectors, £130.

200 compensators, 750-watt, 45 v., £340; 150 compensators, 500-watt, 45 v., £225.

The Melbourne City Council has accepted the tender of the British Westinghouse Electric and Manufacturing Co., for one 1,500-KW. rotary converter with transformer, at £4,562.—*Tenders.*

Bexhill-on-Sea.—The T.C. has accepted the tender of Myres, Rose & Co., for 1,000 tons of coal for the Electricity Works, at £1 6s. 3d. per ton.

Bury.—An offer by Messrs. Drake & Gorham, agents for Edison Accumulators, Ltd., to supply on trial an electric motor cleanser has been accepted by the Cleansing Committee, who have given instructions for a suitable body to be made at the Town's Yard.

Government Contracts.—List of new contracts for August, 1915.

WAR OFFICE.

Distribution boards.—Kartret Engineering Co.

Electric cables and wire.—Callender's Cable and Construction Co., Ltd.; General Electric Co.; Liverpool Electric Co., Ltd.

Galvanometers.—W. G. Pye & Co.; Walter's Electrical Manufacturing Co., Ltd.

Generators.—Phœnix Manufacturing Co., Ltd.

Electric lamps.—General Electric Co., Ltd.; Siemens Dynamo Works, Ltd.

Motors and dynamos.—Electric Construction Co., Ltd.; Electric Ordnance and Accessories Co.; Mawdsleys, Ltd.

Switchboards.—Ferguson, Pailin & Co.

Rubber tape.—Ancoats Vale Rubber Co., Ltd.; Hooper's Telegraph and India-Rubber Works, Ltd.; J. G. Ingram & Son; Chas. Macintosh and Co., Ltd.

Iron and steel wire.—W. Bain & Co; Dorman, Long & Co., Ltd.; Cleveland Wire Mills; Thos. Evans & Co., Ltd.; Richard Johnson and Nephew, Ltd.; Lancashire Wire Co., Ltd.; London Electric Wire Co. and Smith's Ltd.; Recess Screws, Ltd.; J. Rigby & Sons, Ltd.; Rylands Bros., Ltd.; Shropshire Iron Co., Ltd.; Siemens Bros. & Co., Ltd.; D. F. Taylor & Co.; Whitecross Co., Ltd.

Electrical work, Richmond Camp.—Cox-Walkers, Ltd.

Mechanical stokers, R.A.F., South Farnborough.—Underfeed Stoker Co., Ltd.

CROWN AGENTS FOR THE COLONIES.

Aerial Telephone Cable.—Connolly Bros., Ltd.

INDIA OFFICE, STORE DEPARTMENT.

Wireless telegraph apparatus.—Marconi Wireless Telegraph Co.

Cable.—Callender's Cable and Construction Co., Ltd.; Shropshire Iron Co.; Pirelli General Cable Works, Ltd.; W. T. Glover & Co., Ltd.

Copper plates.—T. Bolton & Sons.

Fans.—Electromotors, Ltd.

Standards.—Siemens Brothers & Co.

Telephone sets.—General Electric Co.

OFFICE OF WORKS.

Electrically driven pumps, St. James' Park.—The Rees Roturbo Mfg. Co., Ltd.

POST OFFICE.

Telephone apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Siemens Bros. & Co., Ltd.

Battery boxes.—British L. M. Ericsson Mfg. Co., Ltd.

Telephone Cable.—W. T. Henley's Telegraph Works, Ltd.; Johnson and Phillips, Ltd.; Union Cable Co.

Arc lamp carbons.—General Electric Co., Ltd.

Dry cells.—Siemens Bros. & Co., Ltd.

Leclanché cells.—Siemens Bros. & Co., Ltd.

Opal shades.—Benjamin Electric Co., Ltd.

Electric lighting, Studd Street Stores Extension.—G. E. Taylor & Co.

Great Yarmouth.—The T.C. has accepted the following tenders for the Electricity and Tramways Department :—

1,000 tons half-inch slack and 500 tons hard steam coal.—Cleaves & Co., London.

Overcoats, £1 9s. each; inspectors' do., £2 each.—Hazel & Co.

Motor axle grease, £17, and graphite grease, £17 10s. per ton.—Stern, Sonneborn Oil Co., Ltd.

The Council has declined to entertain the request of the British Thomson-Houston Co., Ltd., for their contract price of cable to be increased from £79 to £90 per mile on account of the increased cost of labour and material.

London.—Messrs. Pope's Electric Lamp Co., Ltd., have secured orders for several thousands of lamps, both carbon and metal filament, from both the Admiralty and the War Office, and also from H.M. Office of Works.

The Metropolitan Water Board has accepted the offer of the Maxim Lamp Works, Ltd., to continue, for a further period of six months their contract for the supply of metallic filament lamps at existing prices. The offer of the British Insulated and Helsby Cables, Ltd., to continue, for a similar period, the supply of tapes at the same price for one item, and at a 5 per cent. increase on two items, has also been accepted.

The "Z" Electric Lamp Manufacturing Co., Ltd., and Reduced, has been awarded by H.M. Office of Works the contract for 12 months' supply of "Z" drawn wire metal filament lamps.

BERMONDSEY.—The B.C. Electricity Committee has accepted the tender of Messrs. Myers, Rose & Co., Ltd., and Messrs. A. Usher and Co., for 3,000 tons of Shipley nuts, at 21s. 11d. per ton, and 5,000 tons of Bolsover nutty slack, at 18s. 9d. per ton, respectively. The electrical engineer has been authorised to purchase for experimental purposes about 25 tons of coke breeze at 12s. 4d. per ton.

The L.C.C. has received the following tenders for installing electric light at the Winchester Street School, Finsbury :—

Napier, Kimber, Ltd. (accepted)	£104
Alpha Manufacturing Co.	146
Automobile and Electrical Equipment Co.	162
A. Hawkins & Sons..	165
Tredegars, Ltd.	172
Titan Lift Co., Ltd.	181
G. Weston & Sons, Ltd.	232
T. W. Vaughan & Co. (1914) Ltd.	242

Lowestoft.—The tender of Messrs. Hadfields has been accepted for the supply of 12 rolled steel car axles, at £3 10s. each.

Sheffield.—The Tramways Committee recommends the acceptance of the tender of Messrs. C. Macintosh & Co., for the supply of 300 winter hats for women conductors, at 2s. 3½d. each.

FORTHCOMING EVENTS.

Iron and Steel Institute.—Friday, September 24th. At the Institution of Civil Engineers, London. Autumn meeting. For particulars see our "Notes," September 3rd p. 308.

Municipal Tramways Association.—Friday, September 24th. At 11 a.m. At the Surveyors' Institution, Great George Street, S.W. Annual Conference concludes.

Association of Supervising Electricians.—Tuesday, September 28th. At 8 p.m. At St. Bride's Institute, Bride's Lane, E.C. Presidential Address by Mr. A. H. Dykes.

Salford Technical and Engineering Association.—Saturday, October 2nd. At 7 p.m. At Royal Technical Institute, Peel Park. Paper on "The Wonders of Coal," by Mr. G. R. Kew.

NOTES.

Appointments Vacant.—Assistant engineer (£2 10s.), linesman jointer (£2 10s.), fitter drivers (£2 10s.), fitters (£2), wiremen (£2), engine drivers (£1 10s.), switchboard attendant (£1 5s), district electrical and mechanical engineers (£3 5s. to £4), for War Department, Southern Command, for military hutment camps; overhead wireman for Ramsbottom U.D.C. railless traction system; switchboard attendant (32s. 6d.) for Plymouth Corporation; switchboard attendant for Derby Electricity Supply Department. Particulars are given in our advertisement pages.

Poisoning in Storage Battery Making.—The results of an investigation into the five principal lead storage battery factories in America are given in a bulletin recently issued by the Bureau of Labour Statistics of the U.S.A. Department of Labour. The inquiry was carried out in order to discover the dangers of lead poisoning incurred by the workers, and disclosed the fact that about 18 per cent. of American storage battery workers suffer from lead poisoning in some form, as against only 1 per cent. in Germany and about 3 per cent. in England. The report states that the difference is due to lack of care on the part of the workmen and to neglect of factory sanitation. In addition to the details of the American industry, the bulletin gives particulars of the measures taken to safeguard workers in the storage battery industry in England, France and Germany.

The returns of the Home Office show that in the eight months ended August, 1915, there were 41 cases of lead poisoning in English electric accumulator works, as compared with 30 in the corresponding period of 1914.

Mathematical Notation. — A leaflet recently issued by the London Mathematical Society, containing a number of suggestions for notation and printing, deals with a subject of very material importance to publishers of scientific and technical literature. Those who are not closely connected with the art of printing probably have no conception of the difficulties which confront the compositor who is called upon to set up an expression such as, *e.g.*, $\epsilon^{-\frac{Rt}{L}}$, and they would be surprised to learn that by writing it in the form $\epsilon^{-R t/L}$, they remove nine-tenths of the difficulty, without in the least interfering with the meaning or lucidity of the expression. At the same time they greatly increase the reliability of the reproduction, for in the latter case there is far less tendency for the type to slip or draw out; mathematical composition is notoriously liable to errors in printing, not only on account of its inherent peculiarities, but also because of the mechanical difficulty in securing the type in place. We therefore heartily welcome the circular above-mentioned, in our own interests as well as those of our readers. We have long made a practice of rearranging formulæ and equations in accordance with the methods which are advocated by the Society, but we should very much prefer that authors would adopt these methods in the first instance, in order to avoid unnecessary labour and reduce the risk of error. The principal points to be borne in mind are the following:—Horizontal bars in fractions, or over a group of symbols, should be avoided; the solidus (slanting line) and parentheses should be used instead. Where, however, equations are printed in separate lines and not in the body of the text, there is less objection to the use of horizontal bars. Dots and bars over or under letters should not be used; they may follow the letters, or accents may be used, without disadvantage. There is no objection to indices, suffixes, &c. The following brief set of examples illustrates these points—which, of course, relate only to MSS. intended for composition:—

Instead of	Always write
$\sqrt{13}$, $\frac{1}{\sqrt{2}}$, $\sqrt{\frac{a}{b}}$, $\sqrt{-1}$	$\sqrt{13}$, $1/\sqrt{2}$ or $2^{-\frac{1}{2}}$, $\sqrt{(a/b)}$ or $(a/b)^{\frac{1}{2}}$, i
$\sqrt{ax^2 + bx + c}$	$\sqrt{(ax^2 + bx + c)}$ or $(ax^2 + bx + c)^{\frac{1}{2}}$
$n \,.\, \overline{n+1} \,.\, \overline{n+2}$, $\frac{\lfloor n+1}{\dot{x}}$, $\dot{x}$, $\dot{r}$	$n(n+1)(n+2)$, $(n+1)!$, $\dot{x}$, $\dot{r}$
$\frac{a+b}{3}$, $\frac{a+b}{v}$, $\frac{p}{q} + \frac{r}{s}$	$\frac{1}{3}(a+b)$, $(a+b)/v$, $p/q + r/s$
$\frac{p + \frac{q}{2}}{\frac{r}{3} + \frac{s}{4}}$, $\frac{x}{y + \frac{z}{t}}$	$\frac{p + \frac{1}{2}q}{\frac{1}{3}r + \frac{1}{4}s}$ $\frac{x}{y + z/t}$
$e^{\frac{-nx}{l}}$, $\int_o^{\frac{\pi}{n}}$	$e^{-nx/l}$, $\int_o^{\pi/n}$

It will be noted that fractions *in common use*, such as ½, ⅓, ¾, may be used freely as here shown, but others such as 17/25 should be written with the solidus.

The Secretary of the London Mathematical Society, Dr. T. J. I'a. Bromwich, informs us that the Society is willing to supply a limited number of copies of this very welcome circular on application.

Limitation of Profits.—The following notice appeared in the *London Gazette* on Tuesday:—

Munitions of War Act, 1915.
5 and 6 Geo. 5, Ch. 54.

Notice is hereby given under the Rules Publication Act, 1893, that it is proposed by the Minister of Munitions, after the expiration of at least 40 days from this date, in pursuance of the powers conferred upon him by Sec. 5, Sub-Sec. 4, of the Munitions of War Act, 1915, and every other power enabling him on that behalf, to issue Rules with respect to the limitation of Profits of a Controlled Establishment.

Draft copies of the said Rules can be obtained in the interval at the office of the Minister of Munitions.

The Electrometallurgy of Zinc. — The electrometallurgy of zinc has for many years been practised successfully at the works of Messrs. Brunner, Mond & Co., Ltd., at Winnington, where spelter guaranteed 99·95 per cent. Zn is produced by the Hoepfner process. The deterrents to the production of zinc by electrometallurgical methods have been three—namely: (1) Difficulty in obtaining a dense, coherent deposit of zinc on the cathodes; (2) large consumption of energy required for the decomposition of the zinc compounds available for commercial electrolysis, no matter whether it be the sulphate, the chloride, or an alkaline zincate; and (3) the difficulty in dissolving a fair proportion of the zinc of the ore.

The first difficulty was mastered years ago, and recent workers in this field have had no trouble in obtaining satisfactory cathode deposits. The second difficulty has limited the electrometallurgy of zinc to places where the anode reaction may be caused to serve a useful purpose, as at Winnington. The third difficulty is common to all zinc hydrometallurgical processes, and refers to the formation of zinc ferrite in the roasting of the ore, zinc ferrite being insoluble, or difficultly soluble, in most agents that are commercially available. For this reason a roasted zinc ore may give up only 60 per cent. of its zinc even to fairly strong sulphuric acid.

Recent work in zinc electrometallurgy has been done at Trail, B.C., and at Bully Hill, Cal. It is intimated that one or both of these plants is shortly going to offer electrolytic zinc in the market. The Anaconda Co. has also taken up this problem in an experimental way.—*Chemical Trade Journal.*

Swiss Electro-Metallurgy and French Connections. Early in 1914 a draft agreement was in course of negotiation between the Swiss Société Electrométallurgique Paul Girod, of Neuenburg, and the well-known French firm of Schneider & Co., of Creusot, whereby the two undertakings would have been brought into intimate association, and the capital of the former reduced from £480,000 to £96.000, and then increased to £200,000. The outbreak of war, however, prevented the conclusion of the agreement, as the financial institutions connected with the Swiss company were unwilling to proceed with the proposed issue of shares and debentures. At the ordinary meeting of the company held in June, 1915, the wish was expressed that the draft agreement should be rejected, and a resolution to this effect was adopted at a further meeting held at the beginning of September. It was pointed out that, as drafted, the agreement was no longer in the interest of the company under the change in circumstances, but that the rejection did not necessarily mean a rupture with the French company, as the Neuenburg company was still open to a fresh proposal of a more favourable nature. It was stated that the French subsidiary company, at Ugine, was exceptionally well employed on army contracts, and its working results for 1915 will presumably enable the Girod company, which has incurred large losses in the past five years, to pay off almost all its liabilities. The directors now have a free hand for taking advantage of the present more favourable situation for placing the undertaking on a firmer basis, either by securing a connection with another company or otherwise.

Charging Electric Vehicle Batteries.—The Electric Vehicle Committee has issued a leaflet of notes for the guidance of persons who wish to make arrangements for charging the batteries of electric vehicles. In the case of a small equipment for charging one or two cars, where D.C. is available at a pressure not exceeding 250 volts, it is recommended that the charging voltage be regulated by resistances, to avoid the cost of installing a motor-generator—except where the supply is on the three-wire system at 220 volts and upwards, in which case the power must be derived from the outers only, and a motor-generator is preferable. Larger equipments should be provided with motor-generators, but where the supply is at 220 volts, two-wire, a balancer is more economical than a motor-generator. With A.C. supply either a motor-generator or a mercury arc rectifier is necessary. Precautions to protect the attendant from shock from the switchgear are outlined, and the equipment recommended for the charging board is specified; three-core "cab-tire" sheathed cable is recommended for connection with the batteries.

The Budget and Business.—We suppose that in all business houses since Tuesday last a good deal of thought has been given to the various ways in which the new taxes will affect our commercial and industrial operations. The abandonment of the ½d. postage rate will probably tell somewhat heavily upon the operations of most trading firms, but in the case of publicity departments, which send out thousands, and perhaps hundreds of thousands of printed circulars and price lists in the course of a few months, it will lead to a serious re-consideration of the old question of circulars *v.* trade Press advertising. The business manager, or in cases the publicity manager, will have to bear in mind that his circulars will now cost him an additional 41s. 8d. per 1,000 for postage. The experience of all of us, whether in business or home affairs is that large numbers of ½d. circulars reach the "W. P. B." unopened—in some cases they never reach the right hands at all. "I don't want to be bothered with circulars!" When the head of the house is away from home, he wants everything sent on "except, of course, any circulars that come." If office waste-paper baskets and kitchen cupboards could talk they would a pretty tale unfold. It will be such considerations as these that will weigh with those who want to adopt the most efficient, because the most direct, and the most permanent way of reaching the eyes of buyers. Of course the same arguments really apply in the ordinary case of lists sent to foreign countries—indeed, more so, for we suppose there is not an office list of addresses that covers all the readers of a well-circulated and widely-read journal that finds its way into all corners of the globe. But just now in connection with the Budget the argument comes with particular force for home purposes. The printed advertisement appearing in a trade journal is not thrown into the waste-paper basket; on the contrary, it is often handed over to a second or a third party, and even then does not reach the flames—it is filed away for reference because, in a sense, it is an up-to-date directory as well as a literary production. The cost of producing price lists, paper, printing, &c., are like everything else higher in consequence of the war, and when one adds the new postage burden, the economy of advertising, considered both per thousand impressions and on the point of efficiency, is very substantial. Of course these are all the most obvious of truths, and they would hardly need restating now were it not essential in all business departments to-day to obviate waste wherever possible.

Russian Nickel.—A note in the *Novoie Vremya* says that a report recently issued on nickel ore deposits in Russia shows that three such deposits have long been known to exist in the Urals; but they were poor, containing but 2 to 4 per cent. of the metal, and therefore at the low prices once ruling the ore was not extracted. But when these deposits came into the hands of strong financial groups their exploitation was begun. At present, the Revdinsk factories are smelting about 600 poods of crude nickel per annum, with 65 per cent. metal content. Additional efforts are being made to discover nickel in the Urals area.

Rifle Club Shoot.—An interesting shoot was decided on Saturday last between the Ediswan Rifle Club and a team from the British Thomson-Houston. A good muster was present, and the result was as shown below :—

10 Shots at 25 Yards.

Ediswan Team.	1st shoot.	2nd shoot.	Totals.
* E. Winterflood	92	98	190
S. Smith ..	88	92	180
— Harrington	89	87	176
W. Golding ..	87	87	174
E. Ralph ..	88	89	173
T. C. Black ..	78	90	168
A. J. Corbett	85	77	162
A. E. Davis ..	72	85	157
			1,379

B.T.H. Team.	1st shoot.	2nd shoot.	Totals.
* Redfern (2) ..	84	78	162
,, (1) ..	71	82	153
Bush	62	72	134
Dunton ..	67	65	132
Abel	78	50	128
Burton.. ..	30	67	97
Butcher ..	34	54	88
† Gowan.. ..	27	39	66
			960

* Winners of silver spoons presented by Edison Rifle Club.
† Winners of wooden spoons, suitably illuminated for the occasion.

Ediswan, 1,379 .. .. .. Average, 86·18
B.T.H., 960 .. .. .. ,, 60·00
419

Mr. Elliott (Ediswan joint sales manager) was in the chair, supported by Messrs. Child, Packenham and Cooke. Mr. Abel, on behalf of the B.T.H. Co., responded to Mr. Elliott's welcome. Messrs. Anderton (Ediswan) and Abel (B.T.H.), were captains, and the place of official scorer was filled by Mr. W. B. Clarke.

Australia on Tariffs and Trade "Capturing."—The *Sydney Morning Herald*, on July 30th, published an article stating that the tariff which was introduced in December last, but was never before the Federal Parliament for discussion, would not be considered by that body until next year. The feeling is that the time is inopportune for discussion. Toward the end of its article our contemporary says :—

"All classes of traders are greatly disappointed with the steps taken by British manufacturers to capture Germany's lost trade. In almost every instance the tariff gives preference to Great Britain, and that being the case, it is thought the British manufacturers might reasonably have been expected to make an endeavour to secure some of the orders which were previously placed with Germany. But it is complained that so far no effort in that direction has been made, and that, instead of the Empire deriving any benefit from the war, as regards new trade, the American and Japanese have stepped in, and are capturing the market for all those goods which, prior to the outbreak of war, came from Germany, Japanese exporters, in particular, are showing great activity, and are straining every nerve to secure the Australian trade. And in many cases they have succeeded."

In the next day's issue of the same paper the secretary of the Association of British Manufacturers replied to the criticism as follows :—

"You make no mention of the numerous handicaps to which British industry is subject at present. These may be summarised roughly as : (1) Shortage of labour through enlistment with the Colours ; (2) shortage of supplies of raw material ; (3) shortage of shipping tonnage ; (4) Admiralty and War Office contracts taking precedence over private orders.

"A review of the various journals published in the United Kingdom which are available here suffices to explain the position. As long as the Mother Country is engaged in a life-and-death struggle with her enemies, the capturing of enemy trade, important though it be, must be relegated to a second place. But to say that British manufacturers have made 'no effort' to capture enemy trade is unjust ; the writer of your article is apparently unaware that there has been held in London a Trade Fair organised by the Board of Trade, and that, as the result of this, satisfactory business is being done by British firms making goods which take the place of those manufactured by the enemy. Since the beginning of the war the British Trade Commissioner in Australia has succeeded in placing many Australian firms in touch with sources of supply, of which they were previously unaware, and much business formerly done with enemy countries has been diverted to the United Kingdom, notwithstanding the handicaps before mentioned."

Institution and Lecture Notes.—Association of Supervising Electricians.—This Association commences its second season on Tuesday, September 28th, at 8 p.m., at St. Bride's Institute, E.C. The presidential address will be given by Mr. A. H. Dykes, A.M.I.C.E. The following programme has been arranged for the ensuing season :—

Tuesday, September 28th, 1915.—Presidential address by Mr. A. H. Dykes.
,, November 2nd.—Paper on "Accumulators," by Mr. R. Rankin.
,, December 14th.—Paper on "Electric Lifts," by Mr. H. Marryat.
,, January 17th, 1916.—Half-yearly meeting and informal discussions.
,, February 28th.—Paper on "Illuminating Engineering," by Mr. L. Gaster.
,, April 3rd.—Paper on "A.C. Motors," by Mr. H. C. E. Jacoby.
,, May 15th.—Paper on "Notes on Electrical Work in Large Buildings," by Mr. F. C. Raphael.
,, June 26th.—Annual general meeting.

Society of Engineers.—On Monday, October 4th, at the Surveyors' Institution, Great George Street, S.W., a paper on "Law and Engineering," is to be read by Mr. S. G. Turner.

British Science Guild.—Owing to the urgent need of scientific organisation, the Guild has decided to publish a *Journal*, of which the first number has come to hand ; it contains a full report of the annual meeting, held on July 1st, at which an address was delivered by Sir William Ramsay on "The National Organisation of Science."

Nottingham Society of Engineers.—The annual meeting is to be held at the Welbeck Hotel, Nottingham, on Wednesday, October 6th, with Major W. E. Walker, the president, in the chair. A syllabus of lectures is being arranged for the 1915-16 session.

Patents and Alien Enemies.—Application has been made to the B. of T. for the avoidance or suspension of patent No. 409/13, granted to the Maschinenfabrik Augsberg-Nurnberg A.G., for cooling internal-combustion engines.

Electricity on the South African Railway System.—Mr. W. W. Hoy, general manager of the Union of South Africa Railways and Harbours, in his official report for 1914, just published, states that the Administration had in contemplation the electrification of certain sections of the railway, and a decision had been arrived at to obtain the services of an eminent consulting engineer to study the local problems and conditions on the spot, and thereafter submit a comprehensive report. "Unfortunately the condition of affairs in Europe and in South Africa has necessitated a postponement of the Administration's proposals. The matter is one, however, which should receive early attention after the cessation of hostilities."

On the subject of electric light and power, Mr. Hoy states that electric light has been installed at a number of stations throughout the system, and in the workshops extensions of electrification schemes have been put in hand. All the Administration's workshops, with the exception of those at East London, are now entirely electrically equipped, and negotiations are proceeding with the East London municipality for obtaining current at a reasonable cost. A new agreement has been concluded with the Bloemfontein municipality for the supply of current for power and lighting purposes. The developments in electrical control signalling, adds Mr. Hoy, are being carefully watched, and installations are being erected at various busy portions of the line.

As regards train lighting, the general manager reports that the electric lighting of coaches has been satisfactorily carried out during the year, and a considerable amount of work in connection with erection and charging of cells has been done. The experiment commenced in 1912 with Edison cells for block train lighting at Cape Town for suburban service having proved entirely successful, is being generally extended in the Cape suburban area. In 1912, a trial was also made with the Vickers train lighting system, six sets being fitted to main-line stock. The trial has proved fairly satisfactory, although no great improvement over other systems has been demonstrated. A further six sets have also been ordered for equipping certain coaches now being erected in England. One equipment was also purchased from Messrs. Mather & Platt, and is giving satisfaction.

Volunteer Notes.—Engineering Institutions' Volunteer Training Corps.—

Company Orders.—By Lieut.-Col. C. B. Clay, V.D., Commandant, for week commencing September 27th, 1915 :—

Drills, 6.30 to 7.30 ; 7.30 to 8.30 p.m.

Monday, September 27th.—Section 1, Technical ; Section 3, Squad signalling class.

Tuesday, September 28th.—Section 2, Technical ; Section 4 Shooting.

Thursday, September 30th.—Section 3, Technical ; Section 1, Shooting.

Friday, October 1st.—Section 4, Technical ; Section 2, Squad signalling class.

Saturday, October 2nd.—Company Parade, 2.30 p.m. Route march.

3rd Batt. (Old Boys) Central London Regiment (Volunteers).—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, September 23rd, 1915 :—

Week-end Parades.—Saturday and Sunday.—Bridging, Bombing and Demonstrations in Field Cookery.

Saturday.—The Battalion will parade at Baker Street Station at 2.30 p.m. and proceed by train to Wembley Park.

Sunday.—7 a.m., Réveillé ; 10 a.m., Church Parade ; 10.20 a.m., Battalion Parade (Bridging, Bombing and Field Cooking Demonstration) ; 2.30 p.m., Battalion Parade ; Bridging and Bombing.

Musketry.—There will be no Shooting at Acton or Bisley on Saturday, the 25th inst., but Acton Range will be open on Tuesday, the 28th inst., and there will be Firing at both Bisley and Acton Ranges on Saturday, October 2nd.

A. G. Joiner, *Major and Adjutant*, O.B.C.

Municipal Tramways Association (Inc.).—Yesterday the annual conference of the Association was opened at the Surveyors' Institution, Great George Street. Alderman H. Linsley, J.P., chairman of the Salford Corporation Tramways Committee, delivered his presidential address, in the course of which he referred to some of the work done by the Council during the past year, and stated that the capital expended on municipal tramways in this country amounted to 56 millions sterling ; the employés numbered over 55,000, and of these over 16,000 had given their services to their country, while many of them had laid down their lives or suffered from wounds in the war. Others had left the tramway workshops to assist in producing munitions of war. The drain upon the population of industrial districts had resulted in heavy loss of income by many tramway undertakings, and the payment of allowances to men who had enlisted had involved an expenditure of £380,000 by municipal tramways, to which must be added the cost of war bonuses and other extra outlays. The scarcity of men had rendered it necessary to employ female labour, and there ware already more than 1,700 women acting as conductors on municipal tramways. Upwards of £23,500 had been subscribed by tramcar passengers to charitable funds connected with the war.

A discussion was then opened by Mr. J. Dalrymple, general manager of the Glasgow tramways, on "Tramway Labour Problems as Affected by the War," and in the afternoon Mr. A. Baker, general manager of the Birmingham tramways, was to open a discussion on "Financial Problems as Affecting Tramways During War-time." To-day the Executive Council and the Managers' Section will meet, and afterwards the annual business meeting will be held.

Inquiries.—A correspondent asks for the name of an ironfounder who would undertake to supply small electrical castings. Makers of "Kingslead Drying Stoves" for photo-prints are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. REGINALD A. HAYSON, who served his apprenticeship at the Corporation electricity works at Swindon, has been granted a commission in the Indian Reserve of Officers, and posted to the 31st Punjabis.

The Ilford Electricity Committee proposes to grant the following increments of salary:—MR. J. R. WILSON (first charge engineer), £170 to £175; MR. G. E. WILLIAMSON (second charge engineer), £140 to £150 (maximum); MR. A. GLAZIER (third charge engineer), £135 to £140 (maximum).

MR. H. HOOPER, senior charge engineer at the Walthamstow electricity works, has resigned his position. It is proposed to promote MR. A. R. MANWARING, switchboard attendant, to fill the vacancy, at a salary of 40s. per week, rising by 2s. 6d. annually to 50s. In this connection the Lighting Committee has recommended the U.D.C. to fix wages of charge engineers at 45s. per week, rising to 55s. per week by annual increments of 2s. 6d., and the salaries of switchboard attendants at 35s. per week, rising to 40s. per week by annual increments of 2s. 6d.

Tramway Officials.—Sergt. M. RATHBONE, formerly manager of the Oldham, Ashton and Hyde tramways, is in the trenches with the King's Royal Rifles.

General.—On September 9th the staff and employés of the KOPPER'S COKE-OVEN AND BYE-PRODUCT CO., and COATES & CO., Sheffield, engaged on the new coke-ovens at Thrislington Colliery, West Cornforth, Durham, held a smoking concert at which Mr. T. M. Craft, chief electrician, was presented with a timepiece on the occasion of his marriage. Mrs. Craft was the recipient of a gold brooch. Mr. J. A. Turner, superintending engineer, made the presentation.

Having fulfilled his engagement with the Government of Burma, MR. HARRY NIMMO is coming home, *via* Malay States, China, Japan, U.S.A., and Canada, for a holiday, after 6½ years' work in Burma's trying climate.

MR. T. P. BROGAN has been appointed chairman of the Battersea B.C. Electricity Committee.

MR. OSCAR JOHN SPARROW, of the staff of the Marconi Co., Chelmsford, who was married on September 11th to Miss Ellen Barrow, has been presented by his colleagues with an overmantel and set of cutlery.

The many friends of MR. HERBERT H. BERRY (Berry, Skinner and Co.) will be pleased to learn that he has now returned to the office, after an absence of nearly 18 months. We congratulate Mr. Berry on his recovery.

MR. N. C. BARRETT, late assistant manager of the British Prometheus Co., has been appointed to a similar position on the staff of the electrical cooking and heating department of Carron Co., Stirlingshire, with whom he has now taken up his duties.

The *Times* announces that the Minister of Munitions has appointed SIR FREDERICK DONALDSON, K.C.B., Chief Superintendent of Ordnance Factories, to act for the time being as Technical Adviser to the Ministry. In the meantime arrangements have been made for MR. V. L. RAVEN, chief mechanical engineer of the North-Eastern Railway, whose services have been temporarily placed at the disposal of the Minister of Munitions by the board of directors, to perform the duties of Acting Chief Superintendent of the Royal Ordnance Factories, Woolwich.

Roll of Honour.—Private R. HOWORTH, of the 7th Battalion Manchester Regiment, has been wounded in the fighting at Gallipoli. He was employed at the British Westinghouse Works, Trafford Park.

Private ALBERT E. ROACH, formerly employed at the British Westinghouse Works, Trafford Park, who has been killed in action at the Dardanelles, where he was serving with the 8th Battalion Lancashire Fusiliers, was 28 years of age, and married.

Corporal GEO. E. BROOME, of the 6th Battalion Manchester Regiment, who has been serving at the Dardanelles, has died on board ship while being invalided home. He was 20 years of age, and was formerly for five years employed in the offices of the Manchester tramways department.

Sapper GREENHALGH, of the Royal Engineers formerly in the drawing office of the Salford electricity department, is reported as missing. He went to Egypt a year ago, and had more recently been serving at the Dardanelles.

Quartermaster-Sergeant T. BRIERLEY, 47, who has been serving with the 8th Lancashire Fusiliers at Gallipoli, has died of dysentery. He was employed for eleven years by the British Westinghouse Co.

Private CYRIL JONES, of the 8th Lancashire Fusiliers, who was formerly employed at the Central Telephone Co.'s offices in Manchester, has been killed in action.

Private A. M. DOIG, of the 6th Battalion Manchester Regiment, who figured in the list of soldiers awarded the D.C.M. last week, was twice wounded—the second time with fatal results. He was 25 years of age, and was an electrical engineer in the employ of the British Westinghouse Co., Trafford Park.

Private B. G. SCHOFIELD, of Oldham, who has been serving with the 10th Manchester Regiment, is officially reported missing. He is 20 years old, and was formerly employed by Messrs. J. P. Hall & Co., electrical engineers, Werneth, Oldham.

Private WALTER RIMMER, of the 1st Manchester Regiment, a disabled prisoner of war from Germany, reached his home at Long Fold, Swinton, last week. Rimmer, who has lost his right foot, was formerly employed by the Chloride Electrical Co., Clifton Junction.

Private W. J. SPENCER, of the 7th Battalion Lancashire Fusiliers, formerly in the telegraph department of the Lancashire and Yorkshire Railway Co., has been killed at Gallipoli.

Sergt. A. E. IRVING, an employé on the Burnley Corporation Tramways, has not only been granted the D.C.M. for gallantry in Flanders, but he has received the Czar of Russia's Medal of St. George for distinguished service in the field.

Rifleman J. A. GIBBONS, of the 12th Rifle Brigade, who was engaged in the West Ham electricity department, has been wounded in action in Flanders, and is in hospital at Birmingham.

Private A. WATSON, of the 6th Lincs. Regiment, who was until his enlistment last August with Messrs. Cutting Bros., electrical engineers, Stamford, has been wounded at the Dardanelles.

Widespread sympathy will be felt with Sir Oliver and Lady Lodge in the loss of their youngest son who has been killed in the Dardanelles. Second Lieut. RAYMOND LODGE, according to the *Times*, was 26 years of age. He joined the South Lancashire Regiment shortly after the outbreak of war. He went through a course of engineering at Birmingham University, and had been associated with the firm of Lodge Bros.

Private G. S. MARTLEW, aged 19, formerly employed at the Atherton generating station of the South Lancashire Tramways Co., has been wounded while serving with the 5th Manchester Regiment.

Rifleman A. N. S. KNIGHT (Rifle Brigade), whose death is reported from Flanders as having occurred on July 30th, was a shift engineer at the Burton-upon-Trent electricity works. He held the degreee of B.Sc., and was trained at the British Electric Plant Co.'s works at Alloa. Subsequently he was at Swansea, and for the last two or three years had been at the Burton-on-Trent works. One of his brothers had been killed at the Dardanelles, and another is also with the Forces.

Sapper ERNEST JACKSON, of the 12th Field Company, Royal Engineers, has been awarded the D.C.M. for conspicuous gallantry at Hooge. His section officer was with a bombing party some distance in front of the trench when he was severely wounded, and an N.C.O. who tried to bring him in was killed. Sapper Jackson left the trench and brought in the wounded officer, and then proceeded with the bombing party. He is 18 years old, and before he enlisted he was with the borough electrical engineer at Preston.

Lc.-Sergt. THOMAS CASS, of the 6th Battalion King's Own Yorkshire Light Infantry, who has been killed in action in France, was employed in the Highways Department of the Leeds city tramways undertaking prior to enlisting last September.

Trooper OSMAN KARL FOWLER, of the Royal Gloucestershire Hussars, has been killed in action in the Dardanelles. He was on the staff of the Gloucester Corporation electricity works, and previously at the E.L. works at Stratford-on-Avon.

Obituary.—The death has taken place, in his fifty-first year, of MR. WM. THOMAS, late chief inspector of the West Ham Corporation tramways. When that system was opened, deceased, who came from Liverpool, drove the first electric car in the borough.

NEW COMPANIES REGISTERED.

Staines Projectile Co., Ltd. (141,584).—This company was registered on September 13th, with a capital of £5,000 in £1 shares, to take over from P. J. Mitchell the benefit and obligation of contracts secured by him from the War Office for the manufacture of shells. So long as Marconi's Wireless Telegraph Co., Ltd., or its nominees, hold 2,499 shares in the company the capital shall not be increased without the consent of that company. The subscribers (with one share each) are: P. J. Mitchell, Caxton House, Westminster, S.W., consulting engineer; H. Shaw, Caxton House, Westminster, S.W., engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. Clark, H. Shaw, P. J. Mitchell, E. Cameron, and Capt. A. Simpson, R.E. (all permanent, subject to holding 500 shares). The above-mentioned company has the right to nominate two directors. Qualification of subsequent directors, 100 shares. Solicitors: Johnson, Weatherall & Sturt, 7, King's Bench Walk, E.C.

Marsh Bros. (Electricians), Ltd. (141,563).—This company was registered on September 13th, with a capital of £4,000 in £1 shares, to take over the business of electrical engineers, and contractors for and dealers in electrical apparatus and appliances carried on by H. Liller and A. Liller at Orchard Place, Sheffield, as Marsh Bros. The subscribers (with one share each) are: A. Liller, Oaklynn, Dore, near Sheffield, cashier; F. C. Young, 45, Bank Street, Sheffield, chartered accountant. Private company. The number of directors is not to be less than two or more than five; the first are not named. Qualification, £500. Solicitor: S. J. Newson, Melbourne Chambers, Cambridge Street, Sheffield. Registered by Jordan & Sons, Ltd., 116-7, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

"Cedes" Electric Traction, Ltd.—Particulars of £4,000 debentures, created August 18th, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £3,000. Property charged: The company's property. No trustees.

Renew Electric Lamp Co., Ltd.—Debenture, dated September 9th, 1915, to secure £500, charged on company's undertaking and property, present and future, including uncalled capital. Holder: E. G. Fishenden, 97, Junction Road, Holloway.

Northallerton Electric Light and Power Co., Ltd. (59,301).—Capital, £6,500 in 2,900 pref. shares of £1 each and 12,000 ord. shares of 6s. each. Return dated March 10th, 1915. 1,151 pref. and 4,861 ord. shares taken up. £1 per share called up on the pref. and 6s. per share on the ord.; £2,609 6s. paid. Mortgages and charges: £5,400. Return of allotments made up to August 13th, 1915, shows further 20 ord. shares allotted for cash.

W. S. Jeal and Co., Ltd.—Particulars of £400 debentures, created September 3rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Drycells, Ltd.—Particulars of £2,000 debentures, created September 3rd, 1915, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the amount of the present issue being £500. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Brilliant Sign Co. (1907), Ltd.—A memorandum of satisfaction in full on September 9th, 1915, of charge dated April 12th, 1912, securing moneys from time to time advanced, has been filed.

Brisbane Electric Tramways Investment Co., Ltd. (67,853).—Capital, £975,000 in £5 shares (75,000 pref.). Return dated June 9th, 1915. All shares taken up. £5 per share called up on 30,024 ord.; £150,120 paid; £824,880 considered as paid on 75,000 pref. and 89,976 ord. shares. Mortgages and charges: £450,000.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 23rd, 1915. 23,600 shares taken up. £236,000 paid. Mortgages and charges: Nil.

Babcock and Wilcox, Ltd. (65,805).—Capital, £1,960,000 in £1 shares (100,000 5 per cent. pref., 200,000 5 per cent. second pref. and 1,660,000 ord.). Return dated May 12th (filed June 24th), 1915. 100,000 6 per cent. pref., 178,356 5 per cent. second pref., and 1,660,000 ord. shares taken up £1 per share called up on 360,000 ord. and 178,356 5 per cent. second pref.; £538,356 paid; £1,400,000 considered as paid on 100,000 6 per cent. pref. and 1,300,000 ord. Mortgages and charges: Nil.

CITY NOTES.

Halifax and Bermudas Cable Co., Ltd.

At the annual meeting held on the 16th inst., at 33, Old Broad Street, E.C., the directors reported that the net result of working for the year ended June 30th, 1915, was an available balance of £10,679, as compared with £10,188 for the previous year. An interim dividend of 3 per cent., free of income tax, had already been paid, and it was now proposed to make a further equal payment, free of income tax, leaving £7,679 to be carried forward. The balance to credit of revenue account, which was last year £11,459, has been debited with £1,500 applied to dividend, and with £7,589 expended in repairs and renewals during the year, and credited with £7,679 surplus revenue of the past year, and it now stands at £10,049. During the year the company's cable has been interrupted on three occasions—by a fishing boat's anchor, by a dredger, and finally by chafing in deep water, where it was found to be in good mechanical condition. The expenditure on repairs has consequently been very heavy. The £7,589 mentioned in the previous paragraph was the cost of the first, second, and part of the third interruption. The balance of the cost of the third accident has not yet been ascertained. The shareholders were asked to approve the establishment of a pension scheme for the staff in accordance with the details of a plan submitted to the meeting.

Direct West India Cable Co., Ltd.

At the annual meeting held on September 16th, at 33, Old Broad Street, E.C., the directors reported that for the year ended June 30th, 1915, the net result was an available balance of £13,553, as compared with £7,866 for the previous year. An interim dividend of 3 per cent., free of income tax, had already been paid, and it was now proposed to make a further equal payment, free of income tax, leaving £11,753 to be carried forward. The balance to credit of revenue account, which was last year £54,989, has been debited with £900 applied to dividend, and with £2,522 expended in repairs and renewals during the year, and credited with £11,753 surplus revenue of the past year, and it now stands at £63,319. The company's cable was for a few days interrupted near Jamaica by earthquake; otherwise the cables have worked efficiently during the year. During the year the remaining debentures (£8,000) have been paid off. The shareholders were asked to approve the establishment of a pension scheme for the staff in accordance with the details submitted to the meeting.

United Electric Car Co., Ltd.

Mr. R. B. Barningham presiding recently at the annual meeting of this company said that the year had been a most trying and anxious one, the outbreak of war having caused practically cessation of their ordinary trade. Corporations were not ordering new cars, and some for which they had tendered had been hung up indefinitely. During the year they had received a fair amount of Government work, but in the face of keen competition the prices were cut very fine and the profit was very small, while in some cases there would be small losses. They had heard about Government work making fortunes, but that had not been their experience so far. Large numbers of firms, having had their normal trade held up, were only too glad to cut in low for Government work to keep their men together; for the same reason, they themselves would endeavour to get as much work as possible. Since the outbreak of war 130 employés (about 25 per cent.) had joined the Army. The result of the year's working was a net profit of £8,552, a decrease of £7,500 as compared with last year. They regretted that they were unable to pay a dividend on the ordinary shares this time, but under all the circumstances the result was a favourable one. The depreciation and general reserve was now over £27,000, an increase of £20,000 in four years. It was a marvellous tribute to the stability of English finance and commerce and the wisdom of the authorities and banking institutions of this country that after thirteen months of war there had been no panic or financial disaster, although there must have been many losses. Nobody could tell what was going to be the end of all this enormous war wastage and unremunerative expenditure. It was bound to cripple the country's trade and finance for years to come. They had sufficient work, chiefly from the Government, to keep their present staff going for the next few months, but the outlook could not be called a bright one.

The report was adopted.

Shawinigan Water and Power Co.—The directors **announce a dividend of 1½ per cent. on the common stock for the quarter ending September 30th.**

Globe Telegraph and Trust Co., Ltd.—The directors **announce a first interim dividend of 2s. per share, free of income-tax, on the ordinary shares.**

STOCKS AND SHARES.

Tuesday Evening.

The proposals of the Chancellor of the Exchequer in the new Budget, drastic as they are, have hardly gone to the lengths predicted by some of our pessimists; and the mere fact of their being known is a certain relief to the many who feel that suspense is a worse evil than realisation. From the Stock Exchange point of view, the additions to the income tax are an unfavourable factor, so far as gilt-edged issues are concerned. Prices of most of these securities are protected, of course, by minimum quotations, but the new taxation will add cogency to the pressure which is being brought to bear upon the Treasury for a revision, if not an entire withdrawal, of these minima. To meet the new taxes, many people will want to sell gilt-edged stocks, and that they cannot do so, because of the minimum prices established, is felt to bear very hardly upon certain cases.

None of the stocks and shares with which these pages are concerned come under the particular classes upon which minima are fixed, but there is a sympathetic influence extending from the one zone to the other. Increased taxation, especially of the direct sort, means that the investor considers himself justified in demanding a higher yield upon his securities; and if the stocks from which he is accustomed to make his choice do not provide him with sufficient scope of selection, he turns his attention to others that return more, so that the better-class stocks, unsupported by their usual buyers, have to yield ground as sellers come in, to find no buyers, except at much reduced levels.

The struggle that is going on between advocates of the voluntary and compulsory systems has had an unexpected effect upon Home Railway prices. Substantial shrinkages have occurred upon the speeches of Mr. J. H. Thomas, and his warnings that the railwaymen for whom he speaks not only want more money, but are prepared to go to extreme lengths if conscription is to be introduced. On this, people started selling their Home Railway stocks, and all the strength which animated the market two or three weeks ago went out of it for the time being.

Electric issues have given way with those of the Steam companies. The public will not look at any of them; and although prices are still above the general range touched a month or two ago, they are sorely disappointing to those who looked for continuance of the forward movement that lifted the prices out of their then slough of despond. Metropolitans at 23¼ are a point down, and, as a matter of curiosity, it may be pointed out that the stock now stands at much the same level as South-Eastern deferred and South-Western deferred.

The respective dividends for 1914 were 1¼, 1, and 1⅝ per cent. As the South-Western line will shortly deserve to be included in the list of semi-electric companies, we may remark that the yield at the present price is 7 per cent. on the money, while on Metropolitan Consolidated it is about 5¼ per cent. The last calculation, however, is worked out on the basis of the 1914 dividends, but the declaration for the first half of 1915—namely, 1 per cent.—went against 1½ per cent. in the previous year. Underground Electric Incomes have managed to maintain their price with the loss of a point only.

There are some who argue that, with taxation so heavily increased and living more expensive, the ordinarily cautious investor will be tempted to depart from his usual path and to seek for high-yielding stocks to mix with more steady-going investments, in order to average a better return than he is accustomed to look for in normal days. If this tendency should materialise, it would mean better prices for such stocks as Underground Incomes, and shares in markets for rubber, mining and oil shares.

The Telegraph market keeps very steady in consequence of the dividends which are being declared. The Globe Telegraph and Trust will pay its usual 2s. per share, free of tax, at the end of the month. The Eastern has declared the regular dividend of 1¼ per cent. on the ordinary stock, free of tax, payable on the 15th proximo, and the Eastern Extension usual dividend is to be paid on the same day. The Direct West India Cable Co., in its report for the year ended June last, shows an available balance of £13,500—an increase of £6,700 over that of 1913-14. The company proposes to repeat the interim dividend of 3 per cent., free of tax, and £11,700 will be carried forward. The Direct Spanish dividend of 2s. per share, tax free, and payable on October 1st, is the same as that of a year ago. These are decidedly satisfactory announcements; and that the money should be paid free of tax must be a cause of special gratification to shareholders, who feel the advantage of this to a much greater extent nowadays than they have ever done before. New York Telephone bonds further advanced to 98¾, but lost part of the improvement. Eastern Extension shares are better; Eastern ordinary is firm at 115. Both the Anglo-American Telegraph stocks have hardened.

Marconi shares have been unaffected by an important arrangement notified last Saturday, to the effect that the company is about to absorb one of its principal competitors—the the Poulsen system. It may be recalled that at the time of the Marconi scandal, the Poulsen system, which was run by the Universal Radio Syndicate, had decided claims to consideration. A syndicate representing the Marconi Co. is said to have made an offer which has been accepted; the *Daily Chronicle* is responsible for the statement. Under present Treasury regulations, it is not likely that anything will be done in the way of raising fresh capital for some time to come. American Marconis are a little better at 16s. 3d., and Canadas braced up to 6s. The recent excitement in connection with the American rate of exchange has somewhat died down, displaced for the time being by the interest taken in the Budget.

Various electricity debenture stocks can now be bought to pay 5 per cent. on the money. There is, for example, a small amount of County of London 4½ per cent. first debenture which can be obtained at 90, thus giving the round 5 per cent. yield; and several others of similar class are available to the buyer. So far as the share list is concerned, prices are dull. County preference are ¼ up, the remainder show no quotable change. Every now and then a small transaction takes place, but it is by no means easy to realise even the best-class shares just now.

Brazil Tractions at 47½ are the fraction higher on the week, although the rate of exchange has latterly shown a tendency to droop. In Mexicans, there is practically nothing doing; the deadlock at which affairs seem to have arrived shows no immediate signs of relaxation, although it is said in some quarters that ceaseless efforts are being made to discover some way out of the extraordinary *impasse*. Canadian industrials are decidedly strong; and any company which is concerned, directly or not, with the making of munitions is enjoying a good market in the Stock Exchange. Private advices from British Columbia report that motor competition has recently been set up in Vancouver against the British Columbia Electric Railway Co., which concern, of course, has for some time past enjoyed a virtual monopoly of street transport.

The manufacturing group is quiet. Henleys eased off to 13⅜, but British Insulated keep firm at 10⅝. The armament division is a little better, prices being helped by an unexpectedly good dividend and bonus—the latter in shares—from the Birmingham Small Arms Co. Nothing of importance is doing in rubber shares; prices keep hard on the whole, and there is a fair amount of trade going on. On the other hand, the copper group is depressed and weak, owing principally to fresh heaviness in the price of the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Sept. 21, 1915.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7⅞	—	£6 13 4
do. 7 per cent. Pref.	7	7½	—	4 16 7
Charing Cross Ordinary	5	3⅜	—	6 13 4
do. do. do. 4½ Pref.	4½	3⅜	—	6 0 0
do. do. City Pref.	4½	3⅜	—	6 0 0
do. 4 Deb.	4	80	—	5 0 0
Chelsea	5	4½	—	5 17 8
do. 4½ Deb.	4½	88	—	4 17 10
City of London	9	12½	—	7 7 0
do. do. 6 per cent. Pref.	6	10½	—	5 11 4
do. do. 5 Deb.	5	100	—	5 0 0
do. do. 4½ Deb.	4½	85	—	5 6 0
County of London	7	10½	—	6 16 7
do. do. 6 per cent. Pref.	6	10⅝	+ ¼	5 14 3
do. do. 1st Deb.	4½	90	—	5 0 0
do. do. 2nd Deb.	4½	85	—	5 6 0
Kensington Ordinary	9	6½	—	7 4 0
London Electric	4	1⅜	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	6 6 4
do. do. 4 Deb.	4	80	—	5 0 0
Metropolitan	3½	2½	—	7 0 0
do. 4½ per cent. Pref.	4½	3⅜	—	6 0 0
do. 4½ Deb.	4½	90	—	5 0 0
do. 3½ Deb.	3½	70	—	5 0 0
St. James' and Pall Mall	10	6⅜	—	7 8 2
do. do. do. 7 per cent. Pref.	7	6½	—	5 12 0
do. do. do. 3½ Deb.	3½	70	—	5 0 0
South London	5	2⅞	—	6 19 0
South Metropolitan Pref.	7	1 7/16	—	6 14 0
Westminster Ordinary	9	6⅜	—	6 18 4
do. 4½ Pref.	4½	4½	—	5 9 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	98½	+ ½	6 2 0
do. Def.	1½	22	+ ¼	6 16 4
Chile Telephone	8	6½	—	6 3 0
Cuba Sub. Ord.	5	8½	—	6 1 3
do. Pref.	10	15	—	6 13 4
Eastern Extension	7	11⅞	+ ⅛	*6 15 0
do. 4 Deb.	4	80	+1	5 0 0
Eastern Tel. Ord.	7	115	—	*6 18 0
do. 3½ Pref.	3½	66	—	5 6 0
do. 4 Deb.	4	81	—	4 19 0
Globe Tel. and T. Ord.	6	9⅜	—	*7 0 8
do. Pref.	6	9½	—	6 8 0
Gt. Northern Tel.	22	33	—	6 13 4
Indo-European	10	50	—	6 10 0
Marconi	10	1⅞	— 1/32	5 6 8
New York Tel. 4½	4½	98½	+ ½	4 11 8
Oriental Telephone Ord.	10	1 13/16	—	5 8 1
do. Pref.	6	1⅛	—	5 6 8
Tel. Egypt Deb.	4½	80	—	5 0 0
United R. Plate Tel.	8	5⅞	—	*8 6 6
do. Pref.	5	4⅞	—	5 2 7
West India and Pan.	1	1⅛	—	8 17 9
Western Telegraph	7	11¾	—	*6 17 0
do. 4 Deb.	4	81	—	4 16 5
Home Rails.				
Central London, Ord. Assented	4	70	—1	5 14 4
Metropolitan	1½	23½	—1	5 6 5
do. District	Nil	14¼	— ½	Nil
Underground Electric Ordinary	Nil	1⅛	—	Nil
do. do. "A"	Nil	5/9	—	Nil
do. do. Income	6	71	—1	*9 11 8
Foreign Trams, &c.				
Anglo-Arg. Trams, First Pref.	5½	8⅜	—	7 6 8
do. 2nd Pref.	5½	8½	—	8 9 2
do. 4 Deb.	4	73	—	5 9 7
do. 4½ Deb.	4½	72	—	6 5 0
do. 5 Deb.	5	74	—	6 15 2
Brazil Tractions	3½	47½	+ ½	7 7 4
Bombay Electric Pref.	6	10¼	—	5 17 1
do. 4½ Deb.	4½	87	—	5 3 0
Mexico Trams	Nil	33	—	Nil
do. 5 per cent. Bonds	—	40	—	Nil
do. 6 per cent. Bonds	—	85	—	Nil
Mexican Light Common	Nil	25	—	Nil
do. Pref.	Nil	30	—	Nil
do. 1st Bonds	—	40	—	—
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
do. 5 Deb.	5	98	—	5 2 0
Manufacturing Companies.				
Babcock & Wilcox	14	2 3/16	—	6 8 5
British Aluminium Ord.	5	1 15/16	—	4 14 1
do. Pref.	6	18/3	—	6 9 9
British Insulated Ord.	15	10⅝	—	7 1 2
do. Pref.	6	5½	—	5 2 2
British Westinghouse Pref.	7½	32/6	—	9 7 6
do. 4 Deb.	4	68	—	5 14 4
do. 6 p. lien	6	101	—	5 19 0
Callenders	15	11	—	6 16 4
do. 5 Pref.	5	4½	—	5 11 3
do. 4½ Deb.	4½	92	—	4 17 9
Castner-Kellner	15	8½	—	4 12 6
Edison & Swan, £3 pd.	Nil	11/-	—	Nil
do. do. fully paid	Nil	1	—	Nil
do. do. 4 Deb.	4	58	—	6 18 0
do. do. 5 % Deb.	5	60	—	8 6 8
Electric Construction	6	13/-	—	9 4 8
do. do. Pref.	7	19/-	—	7 7 4
Gen. Elec. Pref.	6	9½	—	6 6 4
Henley	20	13½	— ½	*8 9 8
do. 4½ Pref.	4½	4½	—	5 0 0
do. 4½ Deb.	4½	92	—	4 17 9
India-Rubber	5	8½	—	5 14 8
Telegraph Con.	20	31	—	7 15 0

* Allowance made for dividends being paid free of income-tax.

Russia.—The Russian Siemens & Halske Electrical Works made a profit of 785,627 roubles in its seventeenth working year (1914). A dividend of 6 per cent. will be paid.

The Russian Tudor Accumulator Co. made a profit of 319,690 roubles in its seventeenth working year (1914). A dividend of 9 per cent. will be paid.

Eastern Telegraph Co., Ltd.—The directors announce a dividend at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the quarter ending September 30th, and the second quarterly interim dividend of 1¼ per cent on the ordinary stock, free of income-tax.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS DURING AUGUST, 1915.

THE August returns of electrical exports business show a reduction of £25,000 as compared with the month of July, and an increase of £107,600 on the total for August, 1914, which stood at £238,621.

The decrease in the exports appears to have affected principally the wires and cables and machinery sections, the latter of these being some £22,000 less than the July total.

The imports and re-exports also show a slight falling off in value as compared with the previous month, the totals of the former being £212,414 for July, as against £202,490, and for the latter £15,097 for July, as against £10,676.

For August, 1914, the imports and re-exports were £87,031 and £10,001 respectively.

The Scandinavian countries and India were our best customers during the month, while New South Wales, New Zealand and Argentina were also large purchasers.

The electrical imports from the U.S.A. show a falling-off of £17,000, whilst those from Holland, France and Switzerland have increased.

Registered Exports of British and Irish Electrical Goods from the United Kingdom.

Destination of exports and country consigning imports.	Electrical goods and appliances.	Wires and cables rubber and other insulations.	Electric lighting fittings and accessories.	Electric glow lamps.	Electric arc lamps and lamp parts.	Electric meters and instruments.	Electric machinery.	Electrically-driven machinery.	Batteries and accumulators.	Carbons.	Telephonic cable and apparatus and electric bells.	Telegraphic cable and apparatus.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Russia, Sweden, Norway and Denmark ...	4,372	8,719	1,991	67	3,348	2,205	7,632	1,803	98	155	17,560	1,886	49,836
German West Africa	...	...	...	...	...	...	...	...	...	...	25	...	25
Netherlands, Java and Dutch Indies ...	157	5,539	684	...	...	...	103	347	51	...	1,107	...	7,988
Belgium	...	...	...	...	...	...	...	...	...	...	...	...	...
France	1,055	470	1,224	47	21	21	3,783	3,105	468	...	1,426	4,414	16,034
Portugal	45	1,788	...	71	...	122	49	22	...	...	928	3,597	6,622
Spain, Canary Isles and Spanish N. Africa...	227	269	86	56	...	263	2,372	38	25	3	66	3,932	7,337
Switzerland, Italy and Austria-Hungary ...	411	...	13	...	...	...	4,761	228	...	...	1	35	5,449
Greece, Roumania, Turkey and Bulgaria ...	555	...	33	12	...	...	427	...	...	...	13	219	1,259
Channel Isles, Gibraltar, Malta and Cyprus...	78	196	31	16	...	181	...	...	17	...	...	4,175	4,694
U.S.A., Philippines and Cuba	352	...	62	65	...	48	5,743	15	19	...	35	1,370	7,709
Canada and Newfoundland	71	...	72	150	...	1,126	3,341	18	1,443	24	...	13,183	19,428
British West Indies and British Guiana ...	65	30	55	19	...	...	...	...	10	20	15	15	229
Mexico and Central America	6	...	12	18	...	...	...	...	...	...	...	962	998
Peru and Uruguay	...	47	71	79	...	...	10	...	...	...	22	289	518
Chile	13	247	4	36	...	...	148	...	82	25	...	68	623
Brazil	388	350	73	202	...	28	444	206	17	2	64	15,670	17,444
Argentina	1,138	4,872	1,232	1,622	457	1,786	3,845	6,031	438	127	2,856	2,353	26,757
Colombia, Venezuela, Ecuador and Bolivia...	...	85	80	372	...	61	155	...	34	10	...	19	816
Egypt, Tunis and Morocco	174	1,565	433	221	192	...	704	...	505	114	47	146	4,101
British West Africa	50	28	116	73	...	...	37	...	88	...	86	749	1,227
Rhodesia, O.R.C. and Transvaal	1,008	1,387	1,852	1,893	...	450	1,059	154	1,294	...	305	5	9,407
Cape of Good Hope	423	855	552	656	...	257	865	65	1,521	29	66	65	5,352
Natal	402	4,042	466	309	...	65	5,641	150	433	48	3,075	...	14,631
Zanzibar, Brit. E. Africa, Mauritius & Aden	309	15	158	306	...	18	186	21	27	...	82	268	1,390
Azores, Madeira and Portuguese Africa ...	33	227	...	33	...	188	764	...	...	...	57	292	1,594
French African Colonies and Madagascar...	19	...	10	57	...	...	45	217	...	...	...	42	390
China and Siam	442	427	1,176	...	...	118	468	88	245	4	...	945	3,913
Japan and Korea	367	...	50	26	1,825	221	464	1,210	761	...	...	...	4,924
India	2,988	8,744	5,170	2,202	128	2,014	8,706	2,614	5,751	86	597	170	39,170
Ceylon	186	34	129	21	...	28	29	...	141	...	16	...	584
Straits Settlements, Fed. Malay States and Sarawak	274	537	293	195	...	...	298	199	186	...	358	147	2,487
Hong Kong	78	247	62	10	...	363	185	...	143	38	30	...	1,156
West Australia	225	1,168	349	791	...	574	5,390	...	26	...	107	19	8,549
South Australia	139	300	159	61	...	208	544	4	14	...	5,758	...	7,187
Victoria	1,068	3,919	1,736	806	...	188	2,668	...	2,998	25	3,687	111	17,200
New South Wales	250	4,458	1,928	2,279	160	1,163	4,328	972	1,787	239	2,80	1,729	22,094
Queensland	20	1,394	209	311	...	32	910	...	101	28	1,164	...	4,569
Tasmania	...	...	136	...	...	...	579	...	...	...	...	98	813
New Zealand and Fiji Islands	887	809	1,913	666	...	337	7,011	537	653	23	8,961	17	21,814
Total, £	18,275	52,768	22,614	13,748	6,131	12,065	73,594	18,042	19,376	1,000	51,715	56,990	346,318

Registered Imports into the United Kingdom of Electrical Goods from all Countries.

Russia, Norway, Sweden and Denmark ...	230	868	135	276	173	...	3,698	97	1,815	408	4,174	11,874
Germany	...	...	...	...	...	...	...	...	...	...	...	...
Holland...	...	3,115	...	7,414	...	...	489	...	690	...	...	11,708
Belgium	...	...	...	...	...	...	...	...	...	...	...	...
France	190	2,390	598	2,977	1,419	585	371	...	6,705	3,907	310	19,452
Switzerland	1,588	6,275	296	39	334	251	1,640	...	62	2,808	...	13,293
Italy	26	2,158	...	...	...	...	945	790	...	110	1,212	5,241
Austria-Hungary	...	...	...	...	...	...	...	...	...	...	...	...
United States	8,806	2,310	3,066	1,305	4,421	90	39,296	49,331	6,675	13,289	4,961	133,550
Total, £	10,840	17,116	4,095	12,011	6,347	926	46,439	50,218	15,947	20,522	10,657	195,118

Additional imports.—Spain, goods, £18; electrically driven machinery, £75; carbons, £3,088. Canada, goods, £89.; wires, £1,489; magnets, £272; machinery, £1,317; carbons, £903; telegraph and telephone apparatus, £171.

Registered Re-Exports of Foreign and Colonial Electrical Goods from the United Kingdom.

Various countries, mainly as above... ...	3,491	98	...	500	...	399	1,215	...	498	262	4,213	10,676

TOTAL EXPORTS: £346,318 TOTAL RE-EXPORTS: £10,676 TOTAL IMPORTS: £202,490

NOTE.—The amounts appearing under the several headings are classified according to the Customs returns. The first and third columns contain many amounts relating to "goods" otherwise unclassified, the latter, doubtless, consisting of similar materials to those appearing in adjacent columns. Imports are credited to the country whence consigned, which is not necessarily the country of origin.

THE BRITISH ASSOCIATION—III.

FRIDAY, SEPTEMBER 10TH.

On the Friday, Prof. Miles Walker read a paper to Section G on "A Self-adjusting Commutating Device" (of which an abstract appears on p. 414).

Mr. Gerald Stoney, F.R.S., expressed the belief that the device might lead to important developments in improvements of commutation of continuous-current machines, which had been one of the bugbears of electrical engineers. His own experience had been more particularly with turbo-generators, and the difficulties of commutation there had been very great indeed. He asked if Mr. Walker had considered the application of this device to turbo-generators.

Prof. Walker replied that the matter had been considered, but the device had not been applied to the turbo-generator.

In the course of the discussion on Prof. Wilson's paper on "Exposure Tests on some Metals and Alloys," Prof. Howe spoke of the importance of the experiments. When they had to put wires out in the open they very often put them up not knowing whether they were going to last or not; it was simply trial and error. He thought it would be a good thing if similar experiments to those just referred to could be made in different parts of the country; wires being placed simultaneously in cities, seaside towns, and country districts to see how they withstood exposure to the different atmospheres. He thought every new alloy put on the market ought to be put with the others, so that it could be ascertained as soon as possible how it withstood exposure to the atmosphere.

Another speaker suggested that the wires exposed should be of different diameters; and it was also stated in the discussion that the establishment of new chemical works in a district would affect the matter, and that things like that would have to be watched.

Prof. Wilson agreed with the views expressed.

The Mathematical Section discussed "Thermionic Emission"—a hot subject on a hot day, said one speaker—and Prof. O. W. Richardson, F.R.S., who opened, said the conclusions at which he had arrived were that the effects attributed to thermionic emission were certainly physical in some cases, probably physical in most, and possibly chemical in a few.

In the same Section Prof. Pierre Weiss gave a highly technical paper on "New Views of Magnetism"; and Prof. W. B. Bragg, F.R.S., and Mr. W. L. Bragg dealt in interesting fashion with "X-Rays and Crystal Structure."

SATURDAY, SEPTEMBER 11TH.

The most unfortunate part of the concluding session in Section G was the fact that, owing to the shortness of time, the authors of the papers were not able to do justice to their subjects. It is a common fault of congresses that timed programmes are never adhered to, and it is difficult to see how a better state of affairs can be secured. Speakers naturally follow most particularly those subjects that interest them, and the preparation of a timed programme is largely a task of speculative character—the times being allocated according to the interest of the papers as roughly judged in the minds of those having the arrangement in hand. The system invariably works out in favour of the earlier speakers, and the last on the bill are, indeed, unfortunately circumstanced. The Section should have closed its proceedings by 12.30, but it was after one o'clock before the closure was applied—and then one paper, "An Investigation of the Thermal Conductivity of Thin Air Films between Parallel and Metal Plates" (Mr. A. A. Griffith), was left out, in the absence of the author.

Prof. E. G. Coker submitted the report of the committee on "Stress Distributions in Engineering Materials."

The committee has been re-appointed and is to continue its work. Prof. Coker said there was no reason why it should not become a permanent committee, because he did not think they would ever get to the end of the subject. Referring to a sample of steel which Mr. Mason produced, showing fracture parallel to the axis, Prof. Coker remarked that these cracks, and other similar evidence, were serious matters, which went to show that the material they had got was, perhaps, not ideal in regard to its condition throughout. They would have to be very careful in future to try to get the material absolutely identical in all respects, so that all the members of the committee would have identical material to deal with.

Prof. Miles Walker, whose paper on "Some Experiments to determine whether there exists Mutual Induction between Masses" came last, good-humouredly remarked that whereas the previous paper (on "Torsion Stresses in Framed Structures") concerned matters represented by thousands and millions of pounds, and was of practical and immense value to those whose interests were involved in the expenditure, his own paper was one of those that were of no use whatever. Nevertheless, it represented one of the inquiries sometimes worth making, and somebody had to do the useless work sometimes.

The President said that although Prof. Walker had got a negative result he was in much good company, and although a negative result was in some ways disheartening it contributed to science.

Prof. Schuster said he thought the paper ought to have been given to Section A as well as Section G; those attending the Mathematical and Physical Science Section would have appreciated its importance. On the question of negative results, he agreed with the President. The pity was that there were so few people who had the courage to undertake research where ultimately they risked having negative results after a good deal of labour, and he was afraid many of those who tried—and he included himself—did not afterwards take the trouble to record the fact that they had had a negative result. One was really doing very great service to the scientific world by recording negative results.

Dr. Hele-Shaw, in closing the proceedings of Section G, addressed himself particularly to Prof. Schuster (the Association President), and informed him that, from the engineering point of view, the opinion was that the Association had been justified in holding its meeting as usual. The matter contributed to the practical science of engineering had been well worth the while, and had not been one whit inferior to that gained in previous years, when there was, of course, an absence of such difficulties as had faced them this time.

Sir William Mather, in a paper read before the Educational Science Section on Saturday on "Education and Industry," said the relationship of the two was as close as that of soul to body. After a brief retrospective view of the subject, Sir William said we were still far below the standard our industries required if we were to compete successfully with those of other countries. No provision had yet been made to continue the education begun in the elementary schools through the years of adolescence; neither had any definite system of continuation schools for the manual worker yet been established. Dealing with the relations of employer and employed, he remarked that a more thorough and enlightened system of education would, in the course of years, render these relations free from the troubles they had had under present conditions. Trade unions and employers' federations existed more for organised defence and resistance than for peaceful progress, and there was as little cause for capital

and labour to be divided as for a household to be divided against itself. The outstanding menace which imperilled our very existence as an industrial nation was the chronic separation of capital and labour into opposing camps. Until the necessity of perfect unity of interest, of motive, and of purpose was recognised and established we were building our industrial edifice on sand; and it was eminently unscientific to build on sand when rock was at hand.

Principal Garnett, of the Manchester School of Technology, spoke of the place of the technical school in this matter.

Prof. Schuster referred to workers and evening classes, and remarked that it was only the most vigorous of working men who could take advantage of these classes. A large number of men who had been in the workshops all day were not, in the evening, in a physical condition to benefit from attendance at evening schools. He did not agree that there were insufficient trained men in this country, and thought the tendency was rather to overtrain the mind.

Mr. James Graham, of Leeds, said that the only rational and effective way to train the rising generation of skilled workmen after leaving the elementary schools was to have half-time in the workshops and half-time in the technical schools between the ages of 14 and 18 years.

General.

As regards the meeting in general, the weather conditions in Manchester were ideal the whole time. There was no rain, an abundance of sunshine, and visitors to the city who expected to find what is commonly spoken of as "typical Manchester weather" were very agreeably surprised. While learned scientists were discussing the smoke question, its effe on the atmosphere, and, generally, painting wholly in black the city of Manchester, a warm and powerful sun was shining outside, and Oxford Street was a thoroughfare of white dresses and straw hats.

There were no excursions this year, and the President (Prof. Schuster), in his thanks to the city for its hospitality, mentioned that the hope had been expressed that the example set by Manchester in the matter of the absence of "side shows" would be followed in other places.

Visits to Works.

But while there were no organised excursions or social functions on the grand scale there were innumerable invitations to members to visit works and warehouses of all kinds. Members were able to visit the electricity stations at Stuart Street and at Frederick Road, Salford; the testing and standardising department of the Manchester Electricity Department at Ardwick; the British Westinghouse works at Trafford Park; the works of Messrs. W. T. Glover & Co., Ltd., Trafford Park; Electromotors, Ltd., Openshaw; the Lancashire Dynamo & Motor Co., Ltd., Trafford Park; Messrs. Mather & Platt, Ltd., Newton Heath; and numerous engineering works; while of the visits to textile factories reference may be made to the spinning and weaving shown at the Brunswick Mill of the Bannerman Mills Co., Ltd., which is now driven by electricity supplied by the Manchester Corporation, instead of, as formerly, by steam.

Altogether the proceedings were educative and enjoyable, and the 1,400 or 1,500 members who attended—the number was well above the early estimates—will long retain pleasant recollections of the Manchester meeting.

It may be added that Sir Arthur J. Evans has been appointed president for next year's meeting of the Association at Newcastle-on-Tyne, and Prof. W. A. Bone, Mr. H. N. Dickson, Sir Daniel Morris, and Dr. A. Smith Woodward have been appointed members of the Council. The 1917 meeting is to be held at Bournemouth.

Industrial Harmony.

(*Concluded from page* 361.)

Mr. Will Thorne, M.P. (a representative of the Trade Union Congress), said he was prepared to agree to the submission of disputes to the Industrial Council, or, better still, to a smaller committee or committees appointed by it. He was opposed to compulsory arbitration, and he advocated the idea of compelling masters and men to meet and discuss disputes before proceeding to the strike and lock-out. He would like to see more conciliation boards set up. Much of the industrial unrest at present was due at bottom to the sharp rise in the price of commodities, in many cases without justification, and if the Government had dealt with the coalfields as they had dealt with the railways there would have been no trouble in that sphere. Under the present system of production he could not see how they could harmonise the opposing forces of employers and employed. They would not have the harmony they desired until there was a better distribution of wealth. The workers were convinced that they were not getting what they were entitled to.

Sir Hugh Bell, the well-known ironmaster, said he thought the previous speaker under-estimated the participation of the working classes in the gross income of the country. In the steel industry, for example, from 70 to 75 per cent. of the cost of steel was labour, and an advance of 10 per cent. on wages would wipe out the whole of the present profit. Improvements in methods of manufacture would produce more profit on a smaller labour bill, and wages might be increased by giving to the workman his share of the increased profit. Unfortunately, the introduction of labour-saving devices often meant temporary disadvantage to the workers, and on that account it was resented, though its ultimate effects were beneficial to the workers. He commended "compulsory conciliation" as a means of helping both sides in a dispute to see where their true interests lay. He and Mr. Thorne, he added, were at one in this, that they both desired to see labour getting its full share of remuneration, provided it gave in return full share of effort.

Mr. Albert Evans, of the Papermakers' Union, spoke of the employment of women, and said there was a suspicion on the part of labour that when the war ended the employing class would take advantage of the chaos to filch from the workers advantages they had fought for for years. They were very anxious about the employment of women to do men's work at lower wages.

Prof. Schuster (President of the British Association) remarked that to say that labour and capital were working for the same end was merely to evade difficulties. They should not minimise the differences that existed.

At the afternoon session on the same day, Mr. Snell read a paper by Mr. G. P. Holden on "Ruskin's Law. Government and Co-operation are in all things the laws of life; anarchy and competition the laws of death."

Prof. Hobhouse said he understood industrial harmony to mean not merely a system in which people rubbed on without strikes and lock-outs, but he looked upon it as essentially one of co-operation in which each individual member of the community, in putting forth his best energies and developing his distinguishing capacities, served the common life. To apply that involved considerations of value and ends, and if they were going to undertake a systematic investigation into this question they must understand that they were dealing with the sphere not of pure fact alone, but with the sphere in which fact and ideal came into contact. In many respects, as stated by previous speakers, the interests of all parties to the industrial bargain coincided. It was in the interest of all parties, for example, that production should be increased and that better processes should be introduced. But he did not think they must take too smooth a view as to the sphere of identity of interest in every case between the parties to the industrial bargain. He thought Sir Hugh Bell took somewhat too easy a view. It did not so much matter to whom the increment of wealth at any given point went, provided that it was saved and that it was devoted to the development of industry; and it was conceivable that if it went into the pockets of the workpeople or the State, for instance, it might as well be devoted to the production as when it went to the employer.

Mr. James Johnston (Manchester) spoke of the influence of the co-operative movement in producing industrial harmony, and gave details of the operations of the Co-operative Wholesale Society.

The Rev. P. H. Wicksteed (Oxford) spoke of the importance of getting at the hard ultimate facts. It would be an enormous help if there could be established anything like approximate agreement as to the fundamental facts underlying the industrial order. The reason why there were plenty of rumours of wars, but no really deadly wars, in the cotton industry, was that the cotton operative knew too much to have a really serious strike. A lot of cotton operatives had themselves an interest in some concern, and there were all sorts of means of knowing what was going on, and there, where they had the facts, they realised the position. But they did not fight; they recognised that the utmost they wanted was not worth fighting for. We were living in an intellectual chaos complicated by moral twists——twists of vision, and the one and only salvation was to get at the underlying facts by experience, by organisation, and by hard thought.

Mr. G. E. Toogood devoted himself to the question of trade union discipline. The trade unions, he said, had rules which made it clear that they recognised the duties of citizenship, the duties towards the employers, and the duties towards each other; and yet in practice those rules were not generally enforced. If a man absented himself from work without good reason, and by his action affected the earning power of other subsidiary workers, according to the rules of most trade unions he was liable to come under disciplinary treatment; but to enforce that rule would mean the creation of a large number of blackleg workers, and the trade union organiser naturally would hesitate before taking steps which would weaken his own power of bargaining. He suggested that industrial agreements should receive public sanction and be enforced by the whole power of public opinion expressed through the law of the land.

Prof. Unwin (Professor of Economic History, Manchester) said the real practical point of difference between the cotton trade and the engineering trade lay in the fact that in the cotton trade the workers had secured a fairly complete control of the division of profits with the employers. There would be a possibility of increased production in engineering by different methods of management. If the same degree of co-operation and control could be secured in that trade as was already secured in the cotton trade, a very large increase might be made in both wages and profits on a harmonious basis. The cotton industry, however, was on much more routine lines than the engineering trades, and improvement in production in the engineering trades would depend far more upon the improved efficiency of individual workers under scientific management. It was possible for people in the cotton trade to watch profits and to secure their share, and that was not at present the case in the engineering trades.

Mr. B. Ellinger (Manchester) expressed agreement with Sir Hugh Bell that for hope of settlement of the problem they must look to the idea of the benefit of both classes coming from the increased production of wealth.

Mr. W. Smalley (Castleton) spoke of the growth of trade unionism, and said that whereas there were now three million workers organised in trade unions, there were not more than a million five or six years ago. Where working people were unorganised there would low wages be found.

The President of the Section then summed up. He pointed in a general way to some effects of the present war—notably the scarcity of food tending to rising prices, and making living more difficult through the lowering of real wages, the demands for war bonuses, and so forth—all tending towards industrial friction, and remarked that we might bear the inconvenience better if we were sure that it was a temporary thing for the war period. But the war had lasted sufficiently long to put a great deal of our industry on a war basis, and when we went back to peace then the converse change had to be made, and the probability was that the friction would be intensified. Upon the general question under consideration he would like to ask them to take a wide general view, because he thought it was only in taking broad views—at the same time, not neglecting any essential details—that they would be enabled to advance this question. What particularly interested him, personally, and what he thought was very fruitful in the debate that day, was that they had heard speakers who quite candidly ranged themselves on one side as employers, or on another side as representatives of organised labour, make a partial admission that there was a tendency towards a large measure of identity of interest between the two. That was extremely hopeful. The ultimate real earnings of labour were its efficiency earnings; but they found among the rank and file of employers and of labour quite a different point of view. They had the employer who thought cheap labour was best for him: on the other side they had the workman who confined his activity in endeavouring, as he said, to get as much out of the employer as he could. The difficulty was that in both those cases the question of efficiency earnings had been thrown overboard completely. One could not produce a panacea to deal with the matter. The best he could do was to suggest certain lines of action which he thought would conduce towards levelling up the laggards on both sides to the standard of the more intelligent and far-seeing. First of all, it might do no harm if both of them had a little more acquaintance with economic principles. In the second place, one could not help being immensely struck with what had been said about the avoidance of disputes in the great cotton trade, and the reason assigned for that; and he thought, taking that as a model, there would be an immense advantage if in other trades there were the same mutual knowledge of the conditions of the trade, both on the side of the employer and on that of the employed. Such knowledge would enable each to know something more about the difficulties of the other. He believed if the employer knew something intimately about how his people lived, and if, on the other side, the people employed knew something of the fight the employer often had to win so as to protect his own living and the living of those he employed, it would introduce the element that once was common in British industry, but was now becoming scarcer and scarcer—namely, a sympathetic appreciation of the prospects and the character of the work amongst those who co-operated in the work. This brought him to his third point, which, at the moment, might seem a little bit ideal. One would like to see both employers and employed taking pride in the work done. The spirit of co-operation and the pulling together and recognising that everybody had a share in the work achieved, would conduce to sympathy and, to a large extent, to the avoidance of friction. After remarking that the principles of co-operation and of profit-sharing, valuable, perhaps, in their own special sphere, would not alone lead to industrial harmony—they had their limits—the President observed that we had only just begun to see the benefit of conciliation, and there, again, we came to a point where there was a considerable amount of agreement between employers and employed—an agreement which found its echo in the striking phrase of Mr. Will Thorne, "compulsory conciliation." It was quite easy to see what Mr. Will Thorne meant, and he (Prof. Scott) would like to draw special attention to the point that the really serious danger that he saw was not conflict between what was called Labour and Capital, but a much more serious possible one of a conflict between different kinds of labour, and he was taking labour in the wide sense—every kind of worker that produced anything productive or rendered any economical service. Any internecine contest of that kind between labour might produce very serious effects in our social structure. The nation as a whole had sufficient resources to deal with any attempt of that kind, and he thought he was right in saying that it was almost impossible for any lock-out or any strike to succeed if public opinion was definitely against it. Now, public opinion really had never had a chance of fully making itself felt. Public opinion must have knowledge, and it was through well-informed public opinion that useful influence could be brought to bear towards effecting a solution by the full discussion of the various points at issue. If that opinion was brought to bear as an ultimate court of appeal in a labour dispute, and if that court of appeal sided definitely in favour of one side, a very little experience would show it was not much good that side striking or attempting a lock-out, as the case might be. Not one of these things alone would do, but those he had outlined and others might conduce very materially towards the prevention, or, at least, the modification, of economic friction.

War Credit and Finance.

A valuable report on "The Effects of War on Credit, Currency and Finance" was presented and discussed on Friday, September 10th, at the proceedings of Section F (Economic Science and Statistics). For the purpose of its investigation the "Conference" divided the whole inquiry into four heads, namely:—(1) The direct effects of the war on credit; (2) Public borrowing as affecting credit; (3) War measures and currency; (4) War and the mechanism of foreign exchanges. The members of the "Conference" felt strongly that the time was not ripe for the presentation of a final report. The present is only an interim report and, necessarily, incomplete, but it has the advantage of attempting to present a picture of momentous events drawn whilst most of them were fresh in the minds of those who had special opportunities for observation. It aimed at focusing a body of reasoned opinion upon the causes and proximate effects of credit movements during the first year of the war. "However much present judgments may be shown by subsequent events to have been in error, in the opinion of the Conference it was essential that they should be recorded." With the report in detail we need not deal here, but it is so useful a document, and on a subject which concerns us all, that we may indicate the nature of its contents.

The more important emergency measures made during the year 1914 are summarised, as are also the direct effects of the war upon credit. The next section has sub-sections dealing with the following matters:—(*a*) Effect of assistance by the Government to banks and financial houses in August, 1914; (*b*) Was their hoarding owing to the war?; (*c*) Emergency measures to meet the need for currency; (*d*) The extent to which these measures were effective, necessary, or desirable; (*e*) Effect of increased paper currency on prices. The reference to public borrowing for the war as affecting credit is divided up thus:—(1) General effects of public borrowing on credit; (2) Effect of the regulations as to the issue of new capital; (3) Extent to which capital is withdrawn from enterprise; (4) Effect of borrowing in Great Britain by Allied Governments. War taxation,

and the war and the foreign exchanges, are the remaining sections, and an appendix discusses the "Third War Loan." The report in its concluding sentences says that economy should be enforced as well as preached, and "the lesson should be the easier in that Germany has already set an example to the whole world. But when all these palliatives and remedies have been adopted there is little doubt that there will remain a great deal to be done, and our weapon for this purpose must be the raising of credits abroad." "No one doubts that the British Government could raise money in the United States on favourable terms."

In the discussion that followed, Dr. Yves Guyot said that on the morrow of the war an enormous mass of fixed capital would have to be reconstituted, railways, houses, and working plant to be reconstructed. The needs would be great, the purchasing power small, and the cost would be increased by the high rate of interest, the difficulties of procuring working plant and instruments, the scarcity of labour, and fiscal surcharges. The only means of repairing losses and increasing the economic power of a nation was to intensify production.

Prof. Scott (the Chairman) observed that he had come to the conclusion that if the country "put its back into the war" and if the cost did not exceed one thousand millions a year we could finance the war indefinitely.

Mr. Drummond Fraser urged the need of a simpler form of Government investment; and Prof. Boyd Dawkins was in favour of taxing war profits. Why, he asked, should not all profits made above a defined level go to the Government? He did not see the slightest difficulty in carrying out the principle which had already been applied by the Government to the railways. He also favoured the taxation of incomes below £160, and declared that on this proposal the working man was ready to do his bit financially in this great war.

In the Economic Section on Saturday, September 11th, the Ven. Archdeacon Cunningham spoke of "Economic Problems after the War." An abstract of his remarks follows:—

Economic Problems after the War.

By W. CUNNINGHAM, F.B.A.

(*Abstract.*)

There can be no accurate forecast of the conditions after the war; but as we have borrowed largely and spent the money unproductively, there is sure to be a heavy burden to fall on some one, though we cannot foresee exactly how it will be borne. We can only indicate hopes and fears as to the possibilities of the future.

During the war there has been an immense outburst of the sense of national duty; we may hope that men will continue to view the affairs of the country with public spirit, and that the *laissez faire* school which identifies national prosperity with the pursuit of private interests is dead.

There has been a great increase of governmental activity, and the experiments made in regard to the nationalisation of railways and the fixing of prices and profits and wages by the State are remarkable. They make an increased sense of the nation as a unit, and indicate that cosmopolitanism has received a check. It is probable that each nation will be on the guard against the risk of being exploited by countries which are more advanced industrially. Great Britain was enabled by the age of invention to use her industrial superiority so as to control the resources of other countries; and though Great Britain has now left her Colonies free to pursue their own development, German organisation and her careful application of science to industry have given her the opportunity of pursuing the same policy.

It is of the highest importance that the problems of the increased burden caused by the war should be clearly stated; and there may be some misgiving lest the habit of mind which has been recently cultivated by English economists is the best for dealing with broad issues. Both consumption and production are necessary parts of the economic process, but the war has shown once more the importance of production—the production of munitions and the organisation of employment; the new school of economists, which gives an exaggerated importance to consumption and leaves production in the background, is not well fitted to deal with the questions. Many economists before the war took a short-sighted view of British interests, and helped to create the impression in Germany that Great Britain was so committed to neutrality that she would present no objection to the invasion of Belgium. By exaggerating the importance of consumption the same school of economists has given an apparently scientific basis to the claims of those who are taking advantage of the war to stand out for higher wages. In so far as the struggle at the Dardanelles has been due to political rather than military considerations they have laid undue stress on the possibility of importing corn from the Black Sea, and have raised the question as to whether cheapness to the consumer may not be obtained at too great a cost in lives.

Manchester Electricity Supply Undertaking.

In Section G, on Thursday morning, Mr. S. L. Pearce, City Electrical Engineer, read a paper on the Manchester electrical undertaking, with special reference to the projected Barton Power Station. The latter was fully described in our issue of January 8th, 1915, with illustrations. The paper was followed by a discussion, opened by the President of the Section.

Dr. Hele-Shaw, remarking upon the storage capacity for two months' supply of coal, said that in these days, when it was necessary to think of the possible total stoppage of coal supplies, the provision of storage for so far ahead was a good thing. He could not see that it would have hurt the Ship Canal Co. at all to have made an arrangement with the Corporation Electricity Department respecting the supply of water for condensing, but, as it turned out, to have to use the sewage effluent at the electricity station was actually going to prove of distinct advantage to the sewage disposal department.

Mr. J. G. Newbigging (Chief Engineer, Manchester Gas Department) said he understood Mr. Pearce to say that he made his calculations of cost on coal at 9s. per ton. Did he think that price would ever be reached? As users of about half a million tons of coal per annum, the Gas Department never hoped to get it as cheaply as that. He thought the charge would be 50 per cent. higher than that for many years to come.

Mr. Gerald Stoney, F.R.S., said he had heard a good deal about the Barton power station, and he thought the lay-out was most complete; he did not see how it could be improved upon. The sizes of turbines Mr. Pearce had selected—15,000 kw. and 25,000 kw.—were very suitable; 15,000-kw. turbines at 1,500 r.p.m. were very suitable at the present time, and about the maximum that was economical for that speed. But the sizes of turbines were going up so rapidly that doubtless by the time Mr. Pearce required his 25,000-kw. turbines, manufacturers would be in a position to give them. Up to the present no turbine had been constructed at more than 750 r.p.m. of this size, although in America they had been made of 30,000 kw. at 1,500 r.p.m. With regard to measuring instruments, it was most important in a power station to measure everything accurately; by that means alone could economy be obtained. Every stage in the process of producing electricity should be absolutely measured and curves made, and then the matter could be watched and economies effected. Touching on the use of sewage effluent, Mr. Stoney asked if there would be any trouble wth the choking of the condenser tubes and getting a skin on them which would reduce the vacuum. Vacuum was everything in such a station for high economy in turbine work, and the turbines Mr. Pearce had chosen were going to be made, he believed, for the highest vacuum possible—somewhere about 29 in. He would also like to know whether there would be trouble about corrosion of the tubes due to sewage effluent. Another point was whether Mr. Pearce had made any provision for getting easily heavy parts of machinery into his engine room. He had allowed for removal from his engine room to his workshop, but was there any connection between that and the main lines of the country so that heavy machinery could be got direct into the engine room without serious handling? That was an important point in modern electric power stations, and one, he was sorry to say, in which many electric power stations were deficient. They ought to be able to lift straight off the truck to the place where they wanted the machinery to be.

Mr. Pearce, in reply, said that he did not expect to be able to buy coal at 9s. a ton, but that was the figure prepared in connection with the Parliamentary inquiry, and at that time there was certainly a reasonable prospect of getting coal at 9s. a ton at Barton. He did not think there was a prospect of their being able to buy coal at 9s. per ton unless they were prepared to accept coal of very inferior quality, and that he doubted. The table he had shown, in which the price of 9s. was mentioned, was to indicate the difference between the conditions at Barton and at the Stuart Street Station, and if they had to pay 50 per cent. more for coal it would apply equally to Barton and to Stuart Street. The dearer the coal, the more Barton would score over the other one. With regard to Mr. Stoney's observations, he was glad to have the endorsement of the correctness of proceeding with turbines of such output as had been mentioned at such high speeds. No one was more competent to pass opinion on that than Mr. Stoney No portion of the Barton scheme had been considered more carefully than the question of condensing water, and very elaborate arrangements would be made at Davyhulme (where the sewage works were situated) to give the electricity department a purified effluent. "We have it on the highest authority," added Mr. Pearce, "that the effluent as we shall receive it will be better than the Ship Canal." As regarded the condenser, they had had before them the possibility of having trouble with the water, and special designs had been introduced into the condenser to eliminate any of the possible dangers mentioned by Mr. Stoney, and also to facilitate matters. Corrosion they did not fear at all. With regard to getting heavy machinery into the engine room, arrangements were being made for a railway line to be brought in for that purpose.

The Manchester Corporation Gas Undertaking.

In the course of a collection of notes on this subject, read in Section G by Mr. J. G. Newbigging, the author stated that the gas works, established in 1817 by the Commissioners of Police, became the property of the Corporation in 1843, and were valued at £3,335,019; the debt outstanding had been reduced to about one million sterling, and nearly 3¼ millions of net profits had been applied to corporation purposes, while the price of gas was less than 2s. per 1,000 cubic feet. Enormous new works had been designed, including an electrical installation for generating the power required in the manufacturing processes, and for the handling of the huge quantities of coal and coke, but owing to the war their construction had been deferred.

After describing the important assistance rendered by the gas works to the State and to industry in general by the development of suitable methods of reclaiming by-products, the author stated that it could not be expected that the success of the department could be maintained unless it were relieved of the burden of contributing large sums annually in relief of rates, at the expense of the gas consumers. Practically the only direction in which town gas could make material progress was in the replacement of smoky solid fuel with gaseous fuel, as the advent of the practical application of electricity had taken away the monopoly previously enjoyed by gas, and it was becoming more and more evident that each of these commodities had to a very great extent its own distinct sphere of usefulness. During the period 1909-13, the increase in the use of electricity for power purposes was no less than 155.2 per cent., and the use of gas for cooking 30.18 per cent., these being the directions in which the respective commodities had made the greatest progress. For private lighting, gas was practically stationary, showing an increase of only 0.2 per cent., while electricity increased 7.5 per cent. During the last decade the use of gas for cooking, heating, and industrial use had made good progress in Manchester, but a much lower price was necessary to encourage its more general adoption.

In the case of a municipality controlling both gas and electricity supplies, Mr. Newbigging held that there was no reason why the former department should not eventually become the gaseous fuel supplier, and the latter the light supplier. The fuel question was of great importance to the nation, and the gas industry had a better opportunity than any other of solving it, and with it the smoke problem, besides economising our coal resources and encouraging the growth of a variety of minor industries.

A Self-Adjusting Commutating Device.

By Prof. Miles Walker.

(Section G.—Abstract.)

It is well known that a continuous current generator fitted with commutating poles will not commutate very heavy overloads, owing to the magnetic saturation which occurs in the iron of the inter-pole. When the excitation becomes very great the saturation of the iron interferes with the proportionality that should exist between the current to be commutated and the commutating flux.

The rating of a frame, regarded from the commutating point of view, may be very much increased if for all loads the excitation of the interpole can be automatically varied so as to give for all loads the right commutating field.

The paper describes a device tried at the Manchester School of Technology which automatically produces the right amount of commutating flux over very wide ranges of load. So effective is the correcting influence, even where the diverter in parallel with the commutating-pole winding is deliberately put out of adjustment, that, whether it be short-circuited or given a resistance equal to five times the proper resistance, the flux will be preserved at approximately the correct value.

Each brush (say, the positive brush) consists of two parts, one part, A, fig. 1, being slightly in advance of the other on the commutator, and lightly insulated from it. The winding on the commutating pole has twice as many turns as one would ordinarily have, and the cross-section of the copper conductor

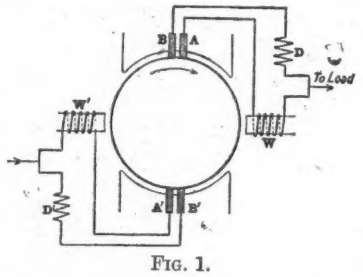


Fig. 1.

is only sufficient to carry one-half of the armature current continuously. Thus the weight of copper on the commutating pole is the same as on machines as at present constructed. The part of the brush B may be connected through a diverter D, having the same resistance as the winding W, or the diverter may be dispensed with altogether. The direction of rotation of the machine is such that a point on the commutator passes first under B, then under A.

Assuming that the number of turns on the commutating pole is such as to give the right commutating flux when half current is passing through them, then it will be found that the current will divide evenly between brushes A and B, because the correct excitation of the commutating pole gives an even distribution of current over the face of the compound brush A B. If, however, the number of turns in W is too great, there is a tendency to over-commutation; that is to say, the current in B becomes greater and the current in A less. This has the effect of automatically weakening the commutating pole, and the pole remains of just such a strength as to bring about the required distribution of current between A and B.

It will be found on machines of ordinary rating, and more particularly on machines of very large rating, that the "correcting" voltage between A and B necessary to bring about a suitable division of current between the two brushes is normally very small, being of the order of .5 volt, whereas the voltage which can be generated between A and B by a pole being too weak or too strong may easily amount to 5 volts or

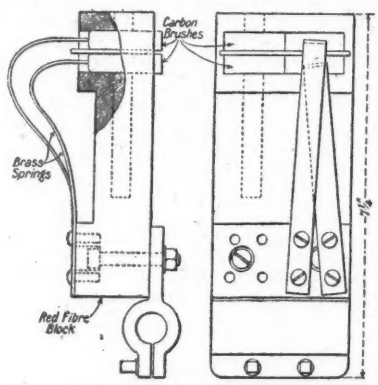


Fig. 2.—Type of Brush Holder for Double Brushes.

more. Thus a very little disturbance in the equality of loading on brushes A and B is sufficient to yield the desired "correcting" voltage.

If for any reason the commutating pole tends to become too weak, owing, let us say, to the saturation of the iron of the pole, the induction of the armature coils carries the current forward to brush A, and tends to increase automatically the excitation of the commutating pole.

We can imagine an extreme case, though it would be difficult to attain in practice, in which the whole of the current would be carried forward to brush A. This would give an excitation on the commutating pole equal to double the excitation that would be obtained with the same load on an ordinary machine. We see that right up to this extreme case we would obtain good commutation—that is to say, up to the point at which the saturation of the pole required a doubling of the ratio between commutating pole ampere-turns and armature current.

The other brush (say the negative brush) may be either a simple one or it may be divided into brush A' and B'. In this case half the commutating poles would be in series with A and the other half in series with A'. A number of experiments were carried out by Mr. H. G. Bell on a 125-kw. 220-volt continuous-current generator in order to determine the amount of "correcting" voltage that could be obtained between brushes A and B. The brush-holder employed is shown in fig. 2 and the result of the experiments in fig. 3. The plan adopted was to change the resistance of the diverter D. The change of the resistance was not accompanied by a corresponding change in the current flowing through the diverter, there being only comparatively small change in the value of the current taken by A and B, and this small change affected the excitation of the commutating pole to such an extent as to generate between A and B a "correcting" voltage, and this voltage forced the current through the higher resistance of the diverter.

In fig. 3 are plotted the values of the "correcting" voltages at different loads for the different resistances of the diverter marked on the curves. Suppose that a current passing through W brings about a commutating pole strength which tends to divide the current so as to give I_B amperes to B and I_A amperes to A. Let the resistance of the diverter by R_D and the resistance of W be R_W. **Then, if $I_B R_D = I_A R_W$**, there will be no "correcting" voltage. If the value R_D be less than necessary for this equation, we will have what is called a "negative" correcting voltage, and if it be greater we will have a "positive" correcting voltage.

It will be seen that if there were no saturation of the commutating pole the value of R_D, which would require no "correcting" voltage, would be a constant. As soon as saturation occurs this ideal value of R_D is increased, as can be seen from the way in which the positive curves in fig. 3 turn over with increase of load.

A number of oscillograms were taken by Mr. Bell showing the behaviour of a generator provided with the correcting device described in this paper, and without the correcting device. It was found that with the correcting device the machine would take nine times full-load current without sparking, whereas with a normal adjustment of the diverter the machine sparked badly at a lower load.

A 500-KW. 500-volt rotary converter, built by the British

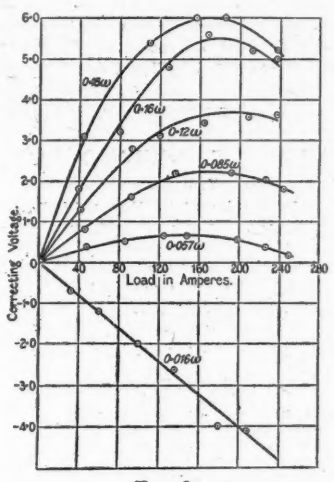


FIG. 3.

Westinghouse Co., was fitted with the double-brush gear arranged as in fig. 1, and was found to give most excellent results. The machine was loaded by circulating the power through a 1,000-KW. converter provided with an alternating-current booster. It was found that with 3,000 amperes flowing (the largest current which could be circulated through rotaries and transformers with the existing arrangement) the commutation was sparkless. The device is being at present installed on a 1,500-KW. rotary converter, on which the commutating conditions would otherwise be rather difficult.

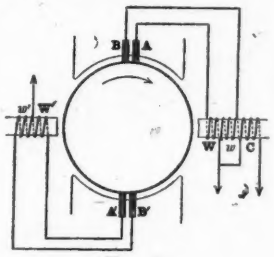


FIG. 4.

An alternative arrangement is shown in fig. 4. Here the current coming from B passes round the coil *w*, so as to give some opposing ampere-turns on the interpole. If the W turns are sufficiently great to wipe out the *w* turns and give the required excitation, then the arrangement works as described in connection with fig. 1. If it is desired to keep W and *w* the same, then the extra turns C can be added as shown in fig. 4. It is found in practice that the simple arrangement shown in fig. 1 is quite sufficiently effective in practice.

The Control of Fuel Consumption.

In the Chemistry Section, on Wednesday, September 8th, Prof. W. A. BONE, presiding in the absence in Flanders of Prof. H. B. Baker, discussed the great national importance of a more scientific control of fuel consumption and the utilisation of coal generally, with special reference to the situation created by the European conflict. He said that notwithstanding the fact that we were raising annually in the United Kingdom some 287 million tons of coal, of which 189 million tons were consumed at home, more or less wastefully, it was surprising how little had been done by the scientific community to impress upon the Government and the public the importance of establishing some systematic control or investigation of fuel consumption in all large industrial areas.

The contending armies depended upon certain distillation products of coal for their supplies of high explosives, and there was little doubt in his mind that Germany's violation of the neutrality of Belgium, and her subsequent seizure of that country and of a large tract of Northern France, had more than a purely political or strategic significance. She doubtless wanted also to seize for herself, and at the same time to deprive her enemies of, coalfields lying just beyond her own borders which were capable of furnishing abundant supplies of coal admirably adapted for yielding the raw materials for the manufacture of high explosives.

Fuel economy and the proper utilisation of coal, whether in connection with manufacturing operations or domestic heating, would become one of the most important national questions during the trying years that would follow hard upon this war; because of all directions in which national economy could be most healthfully and advantageously exercised, this was perhaps the most obvious and prolific. It was tolerably certain that, with an efficient and systematic public supervision of fuel consumption, we ought to be able, even with existing appliances, to save many millions of pounds of our annual coal bill, and with improved appliances still more millions, a saving which would in the long run redeem a considerable amount of the War Loan, which had been much more easily raised than it would be repaid.

He feared that not only were chemists for the most part lamentably ignorant of the nature of coal, and of modern technology, but they had been for many years past so indifferent about such questions that they had been content to leave them almost entirely to engineers, who, as a body, were notoriously deficient in chemical sense and experience. Nearly all that the modern student of chemistry was taught in our academies about combustion was known to Lavoisier, and he questioned whether in the majority of our University laboratories any investigation upon coal or combustion was ever undertaken. And yet the subject was full of the most fascinating and fundamental theoretical problems, for the most part unsolved, and the nation consumed every week as much coal as could be exchanged for the whole quantity of aniline dyes used by its textile industries in a year. Moreover, such advances as had been made in recent years, and they were by no means inconsiderable, had nearly all been in the direction of the wider application of gaseous fuels, yet in how many of our University laboratories was even gas analysis taught, or how many of our schools of chemistry provided systematic courses in the chemistry and manipulation of gases, without which no professional training of industrial chemists, however much research work it might include, ought to be considered satisfactory?

Alluding to the carbonisation of coal, he suggested that public interest would justify the Government in fixing by law a reasonable time limit beyond which no beehive coke oven installations would be allowed to remain in operation, except by express sanction of the State, and then only on special circumstances being proved. There was also much need of a better and more systematic chemical control, in the public interest, of by-product coking plants. He suggested that the Government be memorialised with a view to the establishment of a central organisation for the supervision of fuel consumption and the utilisation of coal, somewhat on the lines of the existing alkali works inspection, which had been so beneficial to the chemical industry. In connection with such an organisation there might be undertaken a much-needed systematic chemical survey of British coalfields, as well as experimental trial of new inventions for fuel economics.

(We are indebted to the *Yorkshire Post* for the foregoing report.)

A Note on "Earth Resistance."

BY PROF. E. W. MARCHANT, D.SC.

(Section G.—Abstract.)

In connection with the wireless station at Liverpool, some experiments have been made recently on the resistance to earth of three different types of earth plate. The earth most used was the water-pipe system of the building; in addition to this, an earth was formed by 14 2-in. cast-iron pipes, pointed and driven about 1 ft. into the ground, which, in Liverpool, is a good yellow sandstone; a third earth was formed by a copper plate 1 ft. 6 in. wide and 4 ft. 6 in. long, buried vertically at a depth at the lower edge of 6 ft. below ground, to which were riveted two copper strips, laid at a depth of 6 ft., each 1 in. wide and 40 ft. long. In both cases described the earth was made by burying the plates direct in the wet sandstone, without a surrounding volume of coke such as is usually recommended.

The specific resistance of the sandstone, when excavated from the soil and firmly pressed into a wooden box with copper plates at opposite faces, was 375 ohms per foot cube, the percentage moisture in the sand being 10 per cent. By measuring between these earths in succession the resistance of each of the three can be estimated. The following results were obtained :—

Earth resistance of copper plate and strip	6.1	ohms.
Earth resistance of iron pipes	42	,,
Earth resistance of water pipes	3	,,

After a very dry spell of weather the earth resistance was found to be about 6 per cent. greater than it was after the usual rainy conditions had prevailed for some weeks.

LEGAL.

Contract Difficulty with Interned Patentee.

In the Patents Court on Thursday last week, Messrs. J. Warner and Sons, Ltd., of the Spitalfields Bell Foundry, applied for power to manufacture an appliance for ringing church bells by electricity, under patents 27,457 of 1907 and 19,199 of 1910, in the name of Carl Herrde, of 33, Great Queen Street, Holborn, who is interned in a concentration camp.

For the applicants Mr. Ernest de Pass, chartered accountant, appeared, and Mr. A. Helbing watched the proceedings for the patentee.

Under the patent, the hammer is suspended within the bell, requiring no counterweight or spring to balance it, and the entire weight is available to ensure a powerful stroke. Prior to this patent the difficulty with electrically-actuated bells had been that, when the hammer struck, contact for the next cycle was made too soon, so that the armature exerted a retarding action on the hammer, which weakened the stroke and diminished the power of lifting the tongue. The patent interposes between the hammer and the armature means to prevent the circuit being closed prematurely, and contact for the next stroke is made at such a time that the effect of the electromagnet is not to diminish the impact of the hammer. A spindle carries one slow wheel and one fast wheel, the former actuating a contact device, and the whole operated by the swing of the hammer. The switch arrangement consists of a fulcrumed bar operating a swinging contact piece, and actuated by a rod, receiving motion from the armature. A keyboard may be fitted, with which tunes can be played electrically on any number of bells; the keyboard, by reason of its electrical operation, may be placed in any part of a church or building away from the belfry. The regulator patent is a dial, with attachments, by which, on placing a pointer at any number, the number of blows, from 3 to 80 per minute, may be struck upon a bell.

Applicants' licence was handed to the Controller of Patents, Mr. Temple Franks, by Mr. de Pass, who stated that while holding exclusive licence from the patentee they were not certain that their contract gave them power to manufacture. Under a certain clause Mr. Herrde had hitherto supplied all the electric fittings. Further, they were troubled as to whether any question could be raised of trading with the enemy. The applicants asked the Patents Court and the Board of Trade for power themselves to manufacture. They were prevented from fulfilling orders they had in hand.

The Controller said it looked as though the patentee granted the company power to sell, use and exercise the patent rights of the invention, and there was a further clause which referred to "manufacturing, selling and disposing of bells." This seemed to indicate that the right to manufacture was given in terms, but a later clause bound Messrs. Warner & Sons to place with the patentee orders for electric fittings to the amount of a certain sum per annum. That was wholly inconsistent with the right which seemed already to have been given to manufacture. The licensees were to be entitled to the sole right to manufacture in the event of the death, retirement, or bankruptcy of the patentee, or in default of his keeping the patents and inventions in full force and effect.

Mr. de Pass observed that the licensees had paid patent renewal fees in the patentee's default, and they said that he had broken his agreement.

The Controller said he must take the view that under the contract the applicants had power to manufacture.

Mr. de Pass said another question was raised. They could do nothing without the tools, drawings and patents for electric fittings, which were at Herrde's office, and these the landlord had seized for rent. He also said he had made advances to the patentee in respect of working.

Mr. Robert Warner, managing director of the applicant firm, stated that they had sold a considerable number of the apparatus, and desired now to manufacture for themselves.

The Controller, delivering judgment, said: As far as the agreement is concerned, I think you may commence to manufacture to-morrow, but you cannot manufacture without tools. The landlord may have a lien on them, and you must take legal opinion on your position there. It is possible after what you have said, and what you have paid, that you may have a prior lien. No question of trading with the enemy arises. As to agreements with alien enemies, generally speaking, the operations are suspended during the war. You cannot receive anything from him or pay him money. There is no need to ask the Board of Trade to annul the existing licence and to give you a new one in different terms.

Metropolitan Munitions Case.

On Monday, at Caxton Hall, at a local Court of the Metropolitan Munitions Tribunal, complaints were brought by a telephone manufacturing company, which is engaged upon war work, against eight of its employés, alleging that on a certain night they took their meals at the wrong hours and absented themselves from important work without leave. The matter is reported in Tuesday's *Times*.

Mr. Burney, the managing director of the company, said that new hours and regulations were put in force as the result of a more complete night-shift. A deputation waited on the firm to protest against the new hours. The men on Friday, September 10th, ignored the rules, got their money, and did not come back. They were still out.

Mr. Swales, a representative from the men's Union, said they were not objecting to long hours, but to the alteration of hours for meals. The proper method in the case of a dispute was for the Board of Trade to be acquainted with the facts, or, in a controlled establishment, the men should have due notice of any change and an opportunity of discussing the matter.

Mr. Burney said that the matter had been taken to the Board of Trade, but the men had held a pistol at the employers' heads.

The President said the Court was satisfied that the rules became known to the men early in the controversy. It was a pity they took that high-handed action. It was a serious offence, and seven of the men would be fined £1 each. The eighth man, who had since returned to work, would be reprimanded.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,730. "Bipolar electrode electrolyzers." G. G. Hepburn. September 6th.

12,747. "Protective devices for electric systems." British Thomson-Houston Co., Ltd. September 6th. (General Electric Co., United States.)

12,748. "Dynamo-electric machines." H. Chitty. September 6th.

12,772. "Electrical switches." A. C. Wynne. September 7th. (Complete.)

12,781. "Electric lighting of vehicles." P. F. Smith & V. S. Robinson. September 7th.

12,792. "Electric lamps." British Thomson-Houston Co., Ltd. September 7th. (General Electric Co., United States.)

12,798. "Multiple-filament electric lamps." L. Simonotti & E. Simonotti. September 7th. (Complete.)

12,810. "Controllers for electric motors." H. E. Dey. September 7th. (Convention date, September 29th, 1914, United States.) (Complete.)

12,834. "Method of generating high-frequency electric currents." T. F. Wall. September 8th.

12,848. "Trolley heads." G. R. Taylor. September 8th.

12,868. "Electric motor control systems." British Thomson-Houston Co., Ltd. September 8th (General Electric Co., United States.)

12,869. "Microphonic detectors." Western Electric Co., Ltd., & G. H. Nash. September 8th.

12,876. "Method of and means for the electrolytic production of gaseous fuel for internal-combustion engines and other purposes." T. R. Cowling. September 8th. (N. L. Cowling, British Expeditionary Force.)

12,882. "Production of continuous electrical oscillations." Marconi's Wireless Telegraph Co., Ltd., & G. M. Wright. September 8th.

12,883. "Electro-mechanical locks for the gates or doors of electric lifts and the like." M. D. Scott. September 8th.

12,924. "Electric heating apparatus." G. Pate & A. R. Wood. September 9th. (Complete.)

12,936. "Apparatus for use in connection with secondary storage batteries." O. Oldham. September 9th.

12,951. "Electro-magnetically-controlled valves for use in connection with the electro-pneumatic actions of organs and like musical instruments." H. Willis, Jun. September 9th. (Complete.)

12,974. "Electrical heat-diffusing apparatus for medical and other purposes." I. Gaunt. September 10th.

12,984. "Electrical cooking apparatus and switchgear therefor." F. S. Grogan & E. W. B. Burder. September 10th. (Complete.)

12,994. "Electric lamps." G. M. J. Mackay. September 10th. (Convention date, September 12th, 1914, United States.) (Complete.)

12,995. "Electric lamps." J. A. Orange. September 10th. (Convention date, September 12th, 1914, United States.) (Complete.)

13,033. "Means for transmitting signals electrically." G. B. Reeve. September 11th.

PUBLISHED SPECIFICATIONS.

1914.

7,821. Enclosed Electric Motors for Driving Machines under Water Signal Ges. March 27th. (March 29th, 1913.)

12,673. Electric Jacquards, Card-punching Machines, or the like. Oesterreichische Siemens Schuckertwerke & Regal Patente Ges. May 22nd. (May 30th, 1913.)

17,246. Transmission of Electrical Impulses over Telephone and Telegraph Circuits of High Electrostatic Capacity. G. Musso. July 21st.

17,328. Means for Controlling the Heating Effect of Electric Heating Apparatus. A. F. Berry. July 21st.

17,329. Electrical Heating Apparatus. A. F. Berry. July 21st.

18,971. Electric Distribution Systems. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). August 22nd.

19,121. Electrical Continuity of Electrical Conduits and other Tubes. R. W. Perry. August 27th.

19,238. Electro-magnetic Track Brakes. D. Storjohann. August 29th.

19,290. Electric Switches. T. G. Nyborg. September 1st.

19,316. Insulators for Aerial Strainers or the like, and the Manufacture thereof. T. Sloper September 1st.

19,483. Electric Telegraphy. W. Judd, Davies & Eastern Telegraph Co., Ltd. September 5th.

19,942. Electric Heating for Metal Working. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). September 18th.

21,157. Points, Switches and the like, of Tracks for Electrically-driven Vehicles. R. Cumming. October 19th.

21,825. Cooling of Dynamo-electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co., U.S.A.). October 31st.

22,744. Grinders for Commutators or Distributors of Ford or other Motor-car Engines. W. L. Ross. November 19th.

23,182. Electric Accumulators. G. Fuller, L. Fuller & G. J. A. Fuller. November 27th.

23,638. Magnetos and other Electric Generators. A. Keller-Dorian. December 5th. (December 6th, 1913. Addition to 8,931/14.)

24,428. Sparking Plug Tester. G. W. King. December 21st.

1915.

58. Means for the Electrical Transmission and Distant Control of Movements, specially applicable to Systems for Signalling Orders and the like. E. A. Graham & W. J. Rickets. January 1st. (Addition to 6,214/14.)

450. Process of and Means for Manufacturing Carbons for Arc Lamps. Compagnie des Charbons Fabius Henrion. January 11th. (January 13th, 1914.)